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USSR REPORT

Cybernetics, Computers and Automation Technology

No. 71

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SURVEY OF PROGRAMS FOR DEVELOPMENT OF COMPUTER TECHNOLOGY

Moscow EKONOMICHESKAYA GAZETA in Russian No 13, Mar 83 p 2

[Survey prepared by the Main Administration for Computer Technology and Control Systems, USSR State Committee for Science and Technology: "From Microprocessors to OGAS [Statewide Automated System]"]

[Text] Management of the economy at all levels and acceleration of scientific and technical progress under modern conditions are inextricably entwined with the development of computer hardware. To this end, the following comprehensive scientific and technical programs are being implemented:

--establishment of a data processing and transmission network on the base of new multiuser computer centers (VTsKP) and those being developed as well as the computer centers in sectors of the national economy as the first phase of the state network of computer centers (GSVTs) in the Statewide Data Transmission System (OGSPD);

--automation of control of manufacturing processes, plants, machines, machine tools and equipment by using mini and micro computers; and

--establishment and development of automated systems for scientific research (ASNI) and computer-aided design [CAD] systems (SAPR) by using standard CAMAC apparatus and measuring-computing complexes.

There are also 12 programs underway to solve major scientific and technical problems in computer engineering.

Computers in Industry

Automated systems for management of enterprises and associations (ASUP) and automated system for control of manufacturing processes (ASUTP) have gained acceptance. They are widespread in the metallurgical industry (over 400), in the chemical, petrochemical and oil refining (about 200), in petroleum (over 100) and power engineering (about 200).

More and more progress is being made in efforts to develop automated systems for scientific reseach (ASNI) and CAD systems (SAPR) in scientific research and design organizations and enterprises.

For example, the multiuser automated scientific research system established in the UzSSR Academy of Sciences Institute of Cybernetics handles data processing and

performance of experiments in eight institutes. The system speeds up processing of seismic and aerospace information 10- to 20-fold, experiments in electronics by 10 to 20 percent, and in nuclear physics by 5 to 10 percent. CAD systems developed at the Central Scientific Research Institute of Construction Design, USSR State Committee for Construction Affairs, have allowed saving more than 3,000 tons of metal, more than 4,000 tons of concrete and speeding up performance of design work by 25 percent in designing a theater in Dzerzhinsk, a sanatorium in Zheleznovodsk, a theater in Barnaul and a Palace of Friendship in Rustavi.

Computers and software for them are the basis for developing all types of systems. As is well known, our industry produces general-purpose computers with a throughput of over a million operation per second (Unified System of Computers and the "El'brus") and minicomputers (of the type in the System of Small Computers).

There are now 180 peripherals for the Unified and 170 for the Small Systems of Computers. Development of computer hardware and software is performed in accordance with tasks of two comprehensive programs.

Organization of series production of microprocessors and microcomputers has allowed introducing computer technology into sectors of the national economy where substantial capital outlays were required for this before. Now in production in the country are 15 types of microprocessor families with instruction execution time ranging from 20 to 0.01 microseconds. About 30 types of microcomputers, controllers and devices have been built on their base. In the 11th Five-Year Plan, production of control microcomputers will increase about 20-fold.

Wide use of microprocessor hardware is producing serious technical and social consequences associated with a change in the nature of teaching people, reducing manual labor and personnel in industry, trade and administrative services. In this five-year plan, microprocessors will be applied in more than 200,000 different types of devices and units for industrial and service functions, and in the 12th Five-Year Plan, they will be used in 1.8 million objects.

Machines and instruments equipped with microprocessors have improved technical and economic indicators and new functional capabilities. Thus, compared to the widespread SM-4 mini, the SM-1800 micro costs 7- to 20-fold less and is capable of raising reliability more than 10-fold, reducing power consumption several 10-folds and reducing computer floorspace needed 20- to 50-fold. The economic effect based on one system will be 150,000 to 200,000 rubles.

Compass in an Ocean of Information

The volume of information circulating in the national economy is equivalent to about 25 million volumes with 500 pages in each. Originated annually in the country are about 60 billion written documents. And by the end of the decade, specialists estimate, the volume of information needed for planning and management will increase 2- to 3-fold.

A process of change is underway in the entire system of acquisition, processing and storage of the data needed for plan calculations and administrative decisions. Computer-based management information systems [MIS's] are here the only possible technical facilities. And in the process, naturally, the models of economics and methods of balance calculations used in them should also be improved.

Automatic acquisition, transmission and processing of information performed by using computers and peripherals are producing a sharp decrease, and in some areas even complete disappearance, of reports and correspondence now customary. Reference, standard and computational materials are stored in memories. Upon request, information can be output both as a printed document and visually, on a television screen. Moreover, industrial documentation (drawings, process charts, specifications, design computations, etc.) is actually prepared in MIS's using computers.

In the 11th Five-Year Plan, a new form of using computers--multiuser computer centers (VTsKP)--is being introduced for the forthcoming unification of MIS's into the unified Statewide Automated System (OGAS).

OGAS must be interrelated on the principles of organizational, methodological and technical unity of the integrated system of functioning of the MIS's for the central statewide agencies (USSR Gosplan, USSR Gossnab, USSR TsSU [Central Statistical Administration] and others), and the MIS's at the sector, republic, association, enterprise and organization levels. This is no "superstructure" above existing managerial agencies nor new economic agency, but a mechanism supporting the joint operation of many MIS's. OGAS will allow all state institutions to receive and send in an automated fashion through the computer centers of their MIS's the information needed in considering intersector and interdepartmental problems.

The scientific and technical program calls for developing in the 11th Five-Year Plan an experimental base for the State Network of Computer Centers (GSVTs) and Statewide Data Transmission System (OGSPD), and working out on this basis the design solutions and technical facilities to support functioning of the first phase of OGAS in the near future.

The introduction of OGAS will allow reducing the cost of information storage and processing in the country by 2- to 2.5-fold and raising the load on computers 30 percent. The State Network of Computer Systems and Statewide Data Transmission System on the principles of multiuse of computer hardware will save, on the whole throughout the country, 24 to 26 billion rubles of capital investment for development of individual computer centers.

Improving the existing MIS's and introducing new ones for the central functional agencies and the territorial MIS's and organizing their interaction in the 11th Five-Year Plan will prepare the basis for their gradual unification into the OGAS.

The first phases of MIS's have been developed in a number of union republics. Now in operation are more than 3,150 computer centers, over 2,600 enterprise and association MIS's and 288 sector MIS's, including in 33 union and union republic industrial ministries. In particular, many alternative annual and five-year plans are computed in the sector MIS's. The greatest effect in these systems is achieved through solving optimization problems, which of course requires even more complex software.

The second phase of the MIS for the State Committee for Inventions and Discoveries was placed into operation in 1982. The annual economic effect from its introduction through reducing information processing costs is about 300,000 rubles. In the Automated System for Processing Price Information in the RSFSR State Committee on Prices (first phase), 57 tasks are handled for computation and estimation of the

price lists of wholesale prices for products and for monitoring temporary prices for consumer goods.

Maximum of Conveniences

In transportation, the shift is from handling separate tasks to optimum management of all processes both in individual types of conveyances and for the transportation system as a whole. This is opening additional capabilities for maneuvering transportation resources.

In 1982, the "Ekspress-2" MIS priority complex of the automated system for management of ticket sales and reservations for long-distance trains was placed into industrial operation in the Moscow rail center; it is a component of the unionwide system for management of ticket sales. The number of passengers served through this system has grown from 200,000 to 450,000 per 24 hours. The number of ticket booths connected to it is increasing from 580 to 2,000.

The total savings in the current five-year plan through MIS's for all types of transportation will be no less than 350 million rubles. By the end of 1985, taking MIS's previously introduced into account, about 40 percent of transportation facilities will be equipped with MIS's.

The main purpose in developing information processing and management systems in public health is to make efficient use of all labor, physical and financial resources in the sector to meet the demand by the population for medical assistance more completely and qualitatively. Here, four main directions in computer applications can be singled out:

--development of a sector automated system for planning and management of public health and MIS's for medical institutions;

--organization of diagnostic medical and analytic laboratory activity in medical institutions;

--use of computers in medical scientific research; and

--preventive health care for the population.

Operating at this time in trade are 64 computer centers and about 50 MIS's at various levels of management. In the sector of culture, efforts are underway on a sector MIS for the ministry, an MIS for the All-Union Association "Soyuzgostsirk," an MIS for the firm "Melodiya," an automated system for the USSR State Library imeni V. I. Lenin, an MIS for the RSFSR Ministry of Culture and the association "Roskul'ttekhnika."

In 1982, work was completed on standard software packages for an automated teaching system oriented to instructors who are not specialists in computers. The innovation can be used in various forms of training activities for a broad range of disciplines in both the natural sciences and the humanities. Such systems have already been introduced in over 100 VUZ's and institutes for raising skills.

New Tasks

The gain in expertise in automating production and the emergence of microprocessors have created the prerequisites for constructing automatic (automated) shops and enterprises for flexibly reconfigurable production without people. For this, a number of major scientific and technical problems have to be solved; chief among them are:

--reliability of equipment and control hardware making up the automatic plant (in addition to the high indicators of quality that must be incorporated in developing elements for equipment, it is necessary to provide for diagnostics and recovery of manufacturing equipment and control systems without interrupting the manufacturing process);

--compatibility of hardware between units and processing equipment with transportation and materials handling equipment as well as with control facilities;

--capability of flexible reconfiguration of manufacturing equipment from output of one type of product to another;

--automation of auxiliary facilities (preparation of tools and machine tools, waste removal, regeneration of certain used auxiliary materials, etc.); and

--automated preparation of production (design of manufacturing conditions, preparation of control programs for design and manufacturing documentation).

Another special-purpose comprehensive program aimed at solving these problems is now being formulated under the direction of the GKNT [USSR State Committee for Science and Technology].

Minpribor, Minradioprom and Minelektronprom [Ministry of Instrument Making, Automation and Control Systems; Ministry of the Radio Industry; and Ministry of the Electronics Industry] have a heavy obligation to computer hardware users. This pertains primarily to peripherals. And secondly, combined centralized servicing of computer hardware has to be fundamentally improved.

In scientific and technical programs, great value is attached to unification and standardization of the hardware and software used to construct systems. Thus, devices for interfacing with objects based on the modular unibus principle are being standardized in developing major microprocessor complexes for automated process control, scientific research and other systems.

Computers, the basis of automation, are serving as a reliable assistant in solving topical economic and social problems in the current and future five-year plans.

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RSFSR EDUCATION MINISTER OUTLINES WAYS OF IMPROVING ENGINEERING EDUCATION

Moscow PRAVDA in Russian 27 Mar 83 p 4

[Article by I. Obraztsov, Minister of Higher and Secondary Specialized Education of the RSFSR, Academician of the USSR Academy of Sciences, Moscow: "The Student and the Computer: The Higher School: An Order for a Specialist"]

[Text] Scientific and technical progress is leading to rapid growth in the amount of information that specialists have to consider in their everyday work. Until relatively recently, total human knowledge doubled in 10 years. In the near future, however, this accumulation will occur every other year. As a result, the percentage of the work force engaged in information processing is continually growing.

It is clear that further progress in raising the quality of training of specialists will depend to no little extent on progress in automating the work of the "information shop" in the country. It is especially important in the short term to develop and widely introduce new technology of data processing in design, scientific research and technical and engineering creativity. And this, in turn, requires advanced training of specialists with the necessary skills and knowledge.

This is no simple task. But the prerequisites for solving it are available. This is indicated by the experience gained by the higher school in the Russian Federation in the last decade based on special-purpose programs developed jointly with the USSR Academy of Sciences. More than 100 VUZ's took part in implementing them. And what are the results?

Computer-aided design [CAD] systems (SAPR) will become the main tool of designers and developers in the near future. Suffice it to say that within 10 to 15 years, every other engineer will have to master the new "technology of creativity," i.e. know how to operate such systems and support development of their data bases and application program packages. To solve this problem, the concept of mastering training CAD systems has been developed in RSFSR VUZ's. These systems allow organizing mass training of specialists meeting the most modern requirements.

This system is sort of a student's "coworker." Future engineers usually begin working with it after the third year and after attending a series of lectures on mathematical modeling. In display classrooms equipped with automated work stations, the student uses the alphanumeric display to first obtain from the computer the reference information needed for designing. Then in the interactive mode, the structure is assembled, its elements are designed, parameters are optimized and

and numeric solutions are obtained on the display screen. But when dimensional characteristics or an image are needed, they can be obtained in the form of sketches or drawings. Design schedules, in the process, are speeded up two- to three-fold.

However, in addition to the "pedagogical" load, the student CAD system also has a productive nature: Just as its industrial "colleagues," it can be used to solve actual structural design problems. This allows new specialists to become quickly adapted in enterprises where such systems are in operation.

By the end of this five-year plan, development of 14 training CAD systems will have been completed. Incidentally, more than 2,000 specialists have now gone through their "school." And starting in 1986, it is planned to reproduce and introduce these systems in other VUZ's and begin developing another 15 to 20 systems.

To justify the additional cost for student training, one has to introduce special-purpose training of engineers geared to orders from industry. In other words, one has to allocate future graduates in advance, after the third year, selecting suitable enterprises for them so that prediploma practice and the diploma project are related to the specific job awaiting them. Then, in essence, we will be able to avoid the current two-year adaptation of beginning engineers, and the field of design will start having additional labor resources. The certainty of meeting the personnel request will also be enhanced since industrialists will be able to more actively influence the professional formation of their junior colleagues by introducing them in good time to the course of interests and concerns of the collective.

The main problem for the higher school here is to integrate scientific research and training. Such integration calls for gradual accumulation in computers of scientific information (in the form of data bases and application software packages) and development of special methodological support and software to make use of it (adaptation) in the training process. Since any study is the process of obtaining new knowledge and teaching is the process of passing on knowledge already known, computer-based automated systems are now being developed on a common methodological basis both in the interests of scientific workers and students. This in turn leads to organizational restructuring: development in VUZ's of scientific training production complexes which must also include the computers. National economic sectors are called upon to help equip modern laboratory bases with computer hardware and peripherals.

However, on the path of development and broad dissemination of the new technology for engineering and technical creativity (ITT), there are also unique difficulties. First, up to now, there has been no such course in the higher school and its introduction will require instructors to give up a number of traditional pedagogical ways and means. Second, using computers to find and invent new, more efficient physical principles of action and engineering solutions is one of the most complex directions in improving intellectual activity.

Nevertheless, a number of researchers and instructors have recently obtained interesting theoretical and experimental results which open possibilities for widespread teaching of engineering and technical creativity and use of computers in training specialists. It was found that it is precisely automation of information processing that removes the main difficulties in mass mastery by students of the

principles of engineering and technical creativity. In our ministry, the concept of efficient use of an automated data bank on physical effects for engineers has been developed and verified by experiment; this data bank is the main means of modernizing processes attending the engineering search.

All this has made it possible to introduce lecture courses on the "Principles of Engineering Creativity and Basic Design," which take into account the specifics of the various groups of engineering specialties. They are reinforced by practical activities where students solve training and sctual problems. The experience of the work done at the Ufimskiy Aviation and Mariyskiy Polytechnic institutes, the Gorkiy University and the Bryansk Institute of Transportation Machine Building has shown that development and mastery of the new technology of engineering and technical creativity will also require closer interaction with enterprises for which the VUZ is training specialists. For this, the training institutions need laboratories or departments engaged in studying the demand and allocation of graduates.

In turn, clients can no longer remain passive "consumers." They have to actively participate in working out formulation problems for engineering and technical creativity and provide meaningful student practice that is well thought out and planned. Moreover, enterprises can no longer adhere to the policy of requesting personnel in the old way, "in a hurry." They will have to learn to define specific positions for the work of specialists two to three years before the arrival of new specialists and to bear the responsibility for efficient use of VUZ graduates. It is believed that it is time to grant universities and institutes the right to turn down clients whose requests and promises in the allocation have subsequently been found groundless.

Since training personnel with enhanced creative potential will require additional physical outlays and money, it is our view that measures for additional incentive to students, instructors, VUZ directors and enterprise employees should also be developed and put into effect.

...There is a trend in the data processing industry to develop integrated systems of computer support to intellectual activity. One such direction is development of automated data banks for multiaspect collective use. Another is the connection of existing automated information processing systems.

Thus, for example, combined systems for CAD and scientific information allow expeditious use of the latest results in experimental research or tests of prototypes in the development of new objects. Also possible are other combinations of modern automation facilities for computer aid to mental activity. Good experience in this direction has been gained at the Ivanovo Power Engineering Institute, Novosibirsk University, the Kuybyshev Aviation, Leningrad Electrical Engineering and Sverdlovsk Mining institutes, the Moscow Machine Tool and Electronic Machine Building and other VUZ's.

Thus, it is a question of generating an entire industry for automatic processing of information that frees the engineer of mechanical, routine work and allows him to focus on the creative part of the project.

The higher school recognizes its responsibility for educating specialists and improving masters with new forms of professional activity. But even the initial phase of the ffort has shown that VUZ's cannot cope with the new problems themselves. They need the help of industry in physical support, in equipping facilities with the most modern computers and apparatus, and mainly, in educating a qualitatively new generation in the country's engineering corps, the people who will be responsible for creating the hardware and industrial technologies of the 21st century. Achieving this union with industry and putting it on a firm legal basis is a pressing task.

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POOR QUALITY OF 'ISKRA-2210' COMPUTERS

Moscow EKONOMICHESKAYA GAZETA in Russian No 48, Nov 82 p 19

[Letter from G. Nikolayev, Kalinin: "Lost Dreams"]

[Text] Enterprises and organizations are buying Iskra-2210 computers, made by the Penzenskiy plant, in hopes of easing the labor performed by workers doing calculations. But hopes are far from always fated to be realized. All the shelves in the repair enterprises are filled with these computers and there are no spare parts.

I recently received a new Iskra-2210 (plant number 09896). It is another piece of scrap. We have 10 small Iskra computers in our organization and every single one is out of order.

It is hard to understand why such a product has been awarded the State Mark of Quality.

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SOVIET UNIFIED SYSTEM COMPUTERS SHIPPED TO CZECHOSLOVAKIA

Moscow EKONOMICHESKAYA GAZETA in Russian No 5, Jan 83 p 21

[Text] In accordance with the contracts between the "Elektronorgtekhnika" All-Union Foreign Trade Association and the Czechoslovakian foreign trade enterprise, "Kovo," the 200th Soviet YeS-1033 computer was recently sent to Czechoslovakia. It has been installed in the new computer center in the CSSR Ministry of Agriculture and Food in Kezhmarok. Soviet Unified System "Ryad" computers are now operating in machine building, transportation and other sectors of the Czechoslovak economy. In 1983, second-generation "Ryad" computers will be shipped from the USSR to the CSSR.

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NEW MICROCOMPUTER DEVELOPED BY 'ENERGOPRIBOR' PLANT

Moscow EKONOMICHESKAYA GAZETA in Russian No 5, Jan 83 p 15

[Photo caption, photo by V. Koshevyy (TASS)]

[Text] Specialists at the Moscow "Energopribor" pilot-production plant have readied a new microcomputer for series production. In size and weight, it is several times smaller than previous models. The new computer is being awaited by automobile plants, enterprises in the oil and gas industry and other sectors in the national economy. Shown in the photo are assemblers-fitters (from left to right) A. Skvortsov, V. Klippert and N. Avramenko assembling a pilot lot of the new microcomputers.

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SYSTEM FOR COMPUTER-AIDED DESIGN OF POWER SEMICONDUCTOR DEVICES DEVELOPED

Tallinn SOVETSKAYA ESTONIYA in Russian 27 Feb 83 p 1

[Article by A. Favorskaya in the column "Third Year of Five-Year Plan": "Object of Automation is Design"]

[Text] Computer-aided design [CAD] can become a reality only when the computer facilities approximate those used by the designer. When he has a display instead of a calculator, a plotter instead of a drawing board, and when he can manipulate problems on a computer, and this means without leaving his work station.

In the last five-year plan in the Scientific Research Institute of TEZ [standard modular system cards] imeni M. I. Kalinin, development of a CAD system for power semiconductor devices--SAPR--began.

It should be noted that prior to this institute's efforts, computer technology in general was not being applied in building power semiconductor devices.

"The CAD system is not simply for making engineering computations with a computer. That became a daily routine long ago. The CAD system allows using a computer to solve a whole complex of problems in the various stages of design," says Valeriy Grigorenko, candidate of physical and mathematical sciences and head of the CAD department which is in charge of these efforts. "In other words, in this case, the object of automation is the design process itself. The computer assumes the burden of engineering computations, output of documentation and providing the necessary information (and this includes the data banks with the normative documents and factors, and that which among designers is called "digging in the references"). We began developing the first phase of the CAD system in the last five-year plan. And development of the second phase has now been included in an All-Union Special-Purpose Comprehensive Program."

Naturally, needed for all this is the appropriate hardware, the very items mentioned in the beginning. And we saw them when the department head took us through the laboratories with displays on work tables and showed us a completely reequipped Computer Center. There, next to a YeS 1033 computer, an automatic "draftsman" had its own workplace. This was the plotter that makes working drawings at once in accordance with GOST [state standards]. Near it was another machine, an auxiliary unit for computer graphics connected directly to the computer. Then we were shown an entire display classroom where, sitting at the display screens, programmers and designers can interact with the computer in the time sharing mode, i.e. everyone

works simultaneously and independent of each other. A printer for output of results is also located handily here. We were told that plans call for installing the same displays and printers in the plant; then plant developers will have access to computer reources from their workstation.

When a device has already been designed, the phase of adjusting the solution begins. And here too, CAD is indispensable. Analysis is needed: why there or here the technology is "jammed" that has to be changed to provide the needed percentage of of output of devices with the specified parameters. Results of tests for manufacturability of the design are processed, redesign of the structure is made, etc.

The display classroom we saw was created within the scope of combining at one stroke a place for those who develop on the computer the programs to automate the activity of engineers and for the users themselves, the designers.

In CAD development, the institute is the lead in its sector. It took part in designing devices in a unified standard series, essentially a new generation of devices which are now being put into series production.

We were interested in the gains from CAD. By using a CAD system, one can derive a solution of such high quality that a designer in the traditional form could never obtain, said V. Grigorenko. Recently assigned as a special order from a production association were measures for arranging in sequence the application of automated methods in designing power semiconductor devices. The purpose is to ensure high technical and economic indicators for the devices developed and produced by the association. When all the devices which are now being refined are put into a series and the planned output of them begins, the national economic effect from introduction of the first phase of the CAD system for power semiconductor devices will be around 2 million rubles. But the main advantage of CAD is the computer "brain." It takes years for designers to master the interrelation of the parameters and the physics of the devices and this is fully mastered by only a few. A [illegible] digital model of the device which forms the basis for the CAD system allows implementing rapid training of new specialists.

Development and introduction of the second phase of the CAD system calls for allowing designers and process engineers to work directly with the computer without being proficient in computer programming.

Top photo: These drawings are made by the computer itself.... T. Toomsalu, a graduate student, and V. Krivchikova, an operator, are at the plotter.

Bottom photo: In the display classroom. In the foreground, senior scientific associate O. Bazanov computes the interrelation of parameters for a power thyristor being designed.

Photo by K. Liyv

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NEW SM-1600 COMPUTER IN PRODUCTION AT VILNIUS PLANT

Vilnius SOVETSKAYA LITVA in Russian 24 Mar 83 p 1

[Article by V. Danilyavichyus: "Family of Computers is Growing"]

[Text] The scene is the assembly shop in the Vilnius Computer Plant imeni V. I. Lenin. Silence reigns here, which is unusual for a machine building enterprise. People in white smocks were intently bent over instruments, checking their activities with a complex diagram from time to time. Behind this silence, however, one sense an intense productive atmosphere.

The group in the shop is now going through a critical period. Series production of a new computer, the SM-1600, is being assimilated here. It differs from its predecessors by improved compacyness, energy consumption and time for solving problems.

Working intensely in a section of the shop is the brigade of fitters and assemblers led by A. Miloserdnyy.

I asked him, "Has the work become more complicated?"

"On the contrary," he answered. "Complexities in the assembly process have declined. But the interest accompanying the development of the new product has increased among the members of the brigade. The boys are working enthusiastically, but with a great sense of responsibility. After all, the efficiency of the working rhythm of the entire shop depends on us."

The enterprise group is obligated to provide continual improvement of computer hardware. Proper organization of socialist competition allows them to successfully accomplish this task. In the assembly shop, for example, there is an efficient setup for accounting for the work of each participant in work competition and wide publicity is ensured. This helps to correctly determine the results of the competition and allows members of the group to rationally distribute their forces.

Series production of the new computer is the major task for the enterprise group. Successful accomplishment of this is being specially monitored by management and the party organization at the plant.

But for now in the second quarter at the enterprise, it is planned to put out several new computers. Working on the final operations will be one of the best brigades in the electronic shop, the group of adjusters headed by V. Aydukas.

Shown in the photograph [not reproduced] is the section for checking out the new machines. Brigade leader V. Aydukas (at left) and adjuster A. Shikshnyalis are at work. (Photo by V. Ol'shevskiy)

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APPLICATIONS

UDC Δ65.041.56:621.951.1

AUTOMATED SYSTEM FOR CONTROL OF DRILLING OF PRINTED CIRCUIT BOARDS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 2, Feb 83
pp 27-28

[Article by engineers S. D. Perekhvatov, A.F. Abramov, V. P. Shlegel' and I. D. Orlov in the section entitled "Economics and Organization of Production"]

[Text] Computers are now being used extensively in controlling manufacturing processes. An example of this is the automated system for control of drilling of printed circuit boards [PCB's] that is described below.

The system controls a section consisting of 15 drills with ChPU [numeric program control = NC]. Domestic types are the S-128M, and the foreign are Alpha-Z (United States), Multifor-II (Switzerland), and the ABL-24 (FRG).

Modes of control of the drills for the domestic types are direct control from a computer (through a nonstandard unit for drill control), and for the foreign, combined control from a computer (control from a computer by using a machine control unit (BUS) and an NC device).

The system permits: simultaneous control of positioning and drilling; consecutive drilling of batches of boards of the same type set on the machine table (32 is the maximum number of batches); recomputation of coordinates of control program as a function of the value entered by the machine operator for adjustment with angular displacement of the pattern relative to base holes; output of the control program to perforated tape; use of a central dispatch console (PTsD) to monitor the operation of each channel for controlling the tools; display of on-line process information for one of the 15 machine tools upon request by the system operator; printout of accounting information at the end of a shift; and preparation of the accounting information for higher levels of management.

A diagram of the automated process control system is shown in fig. 1. One channel of control of a drill machine of each type is designated as follows: I for the S-128M, II for the Alpha-Z and ABL-24, and III for the Multifor-II. The system is a single-level system. Used as the control computer complex (UVK) is a specialized complex on the base of the SM-1 No. 4 control computer complex.

An intermediate device between the control computer complex and the equipment in all channels for controlling the tools is the BUS [machine control unit]. A nonstandard interface module (MS) effects communication between the control computer

Key:
1. S-128M
2. control
3. signals
4. Zapros UUS [request for information on next hole]
5. BUS [machine control unit]
6. MS [nonstandard interface module]
7. request UVR [recommendations unit]
8. SM-1 No. 4
9. channel for communication with ASUP [automated production control system] (M4030)
10. PTsD [central dispatch console]
11. call keyboard
12. light display
13. MVVIS [module for input of initiative signals] A622-8/1
14. MKUB A641-9
15. ASUP [automated production control system]
16. MKUB A641-9
17. system
18. MKUB A641-9
19. breahdown
20. MVVChIS [module for input of numeric pulse signal] No. 1 A623-3/13
21. KPX [end of X positioning]
22. MVVChIS No. 2 A 623-3/13
23. KPY [end of Y positioning]
24. unit for issuing recommendations [UVR]
25. Zapros UUZ [request for information on next hole]

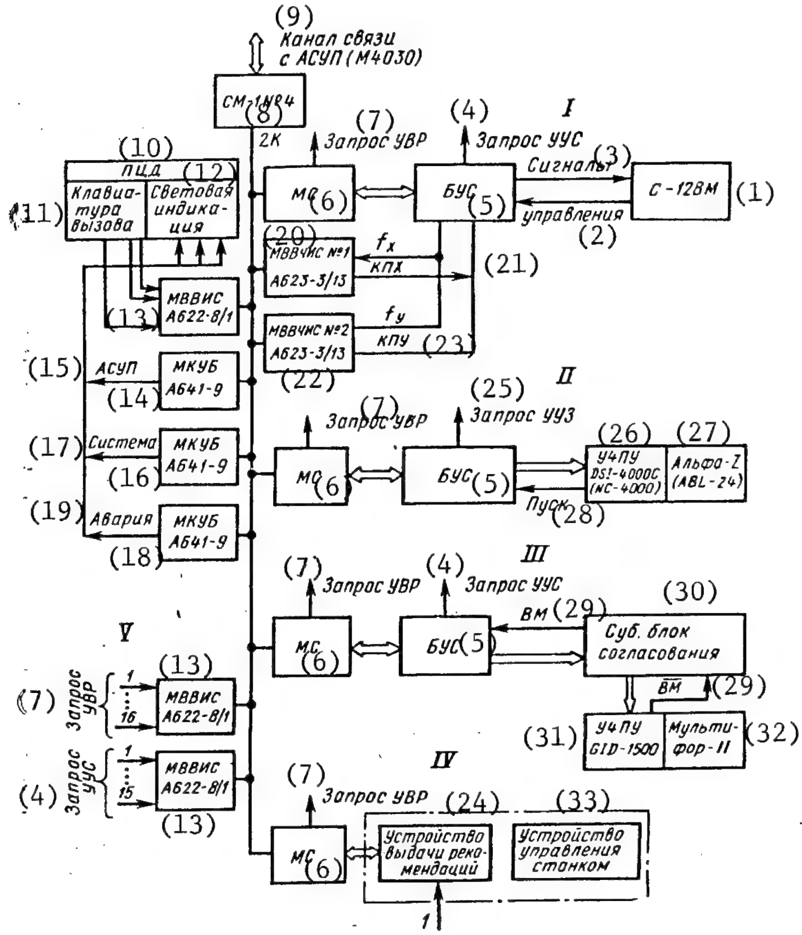


Fig. Diagram of automated system for control of drilling of printed circuit boards

26. UChPU [NC unit] DSI-4000C (NC-4000)
27. Alpha-Z (ABL-24)
28. start signal
29. VM [signal for request of entire frame of control program]
30. matching subunit
31. UChPU [NC unit] GID-1500
32. Multifor-II
33. machine tool control unit [UUS]

complex and the machine control unit. When the control computer complex is done, machine tools are controlled by the standard NC units.

The general principles for system functioning are as follows. The NC machine tool operator uses the keyboard on the front panel of the machine control unit to enter the decimal number of the PP [PCB] and drill bit diameter (or the operator obtains

this information from the control computer complex), number of boards placed in the machine, and then enters this information into the control computer complex. When the control program is stored in the complex, the operator loads the machine and pushes the start key to initiate sending the control program to the machine control unit.

Information on the value of change in position with respect to the $\pm X$, $\pm Y$ coordinates is stored in the MVVChIS [modules for input of numeric pulse signals] A623-3/13. These modules receive pulses from single-revolution couplings of the machine tool (f_x, f_y). Upon overflow of the counters in the modules, signals "end of X positioning" (KPX) and "end of Y positioning" (KPY) are generated and processed by the machine control unit using the defined algorithm, generating the "drilling" command. Upon the signal "end of drilling", information on the next hole is requested ("Request UUS [machine-tool control unit]").

The NC machine tool generates a "start" signal which indicates a request for a line of the control program. The machine-tool control block issues the signal "request machine-tool control unit" (UUS) upon which the control computer complex sends the bytes of information of the control program to the NC machine tool DSI-4000C (or NC-4000).

The Multifor-II NC machine tool generates a request for an entire frame of the control program ("VM" signal). This signal is converted in level in the matching subunit and goes to the BUS [machine-tool control block], where upon the "VM" signal, an initiative signal ("Zapros UUS") is generated for each line in the frame of the control program. As soon as the entire frame of the program is transferred to the NC machine tool, the "VM" signal is removed and subsequent processing of the frame is implemented by the NC machine tool itself.

Information 1 on the finished product is entered through channel IV also by using the BUS [machine-tool control block] at which are placed the unit for issuing recommendations [UVR] and the OTK [department of technical control] set up at the workstation for the controller. Information on the decimal number and number of boards, which have passed through the OTK, is entered into the control computer complex for preparation of accounting information for higher levels of management and for output to the printer at the end of the shift.

Channel V for input of initiative signals consists of two standard modules, included in the nomenclature for the SMEVM [System of Small Computers], of the type MVVIS [module for input of initiative signals], A622-8/1.

The central dispatch console is controlled by three MKUB A641-9 and one MVVIS modules. From this console, the process engineer-operator can call to the screen of the alphanumeric display on-line process information on each of the 15 machine tools included in the system and monitor the operation of each channel for control of a machine tool.

The hardware is positioned as follows: the control computer complex with peripherals and the central dispatch console are assembled in the machine room, the modules controlling the central dispatch console are located in the input/output

interface (SVV, A151-6), and the BUS [machine-tool control block] at the work-station for the machine-tool operator. Interface modules and the MVVChIS [modules for input of numeric pulse signals] are placed in two splitters of multiplex interfaces (RIM, A714-5/1, A714-5/2) which are located in the drilling section in the distributing cabinet. Also located here are the power supplies and distributing panels used to make all necessary connections. Maximum distance between the distributing cabinet and the control computer complex is 3 km.

The SM-1 software is both general and specialized. Used as general software is the DOS ASPO [modular software system]. Specialized software allows monitoring information coming from operating personnel.

Information support for the system provides the capability of expanding information files with regard to increasing the number of machine tools.

Programs supporting functions of the automated process control system are divided into three groups: control of drilling, preparation of control programs, and printout of information on the machine tools per shift and putting this information on ML [magnetic tape] for transfer to the ASUTP [automated manufacturing process control system].

All three groups of programs are assembled as separate load modules.

This system was developed at the Ryazan Manufacturing Process Design Institute and is now being introduced at the Orlov plant for UVM [control computers].

Experience of introducing the system will allow defining the possibilities of improving its operating characteristics and expanding service functions for preparation and correction of control programs.

8545
CSO: 1863/118

COMPUTER-AIDED DESIGN OF NUCLEAR POWER PLANTS

Yerevan KOMMUNIST in Russian 17 Mar 83 p 2

[Article by A. Terzyan, doctor of engineering science: "Horizons of Science: Computer as the Coauthor"]

[Excerpt] Major changes are taking place in optimum design in connection with the application of computers. In the electrical equipment sector, efforts on computer-aided design [CAD] in the country were initiated by Academician A. G. Iosif'yan. /Today we can state the fact of formation of the school of CAD in Soviet Armenia/ [boldface]. In particular, the All-Union Scientific Research and Design Institute Institute of Complex Electrical Equipment (VNIIKE) of the "Armelektromash" Production Association has been appointed lead organization for CAD systems for electrical machines for autonomous power generation.

The efforts in this direction come under one of the unionwide special-purpose comprehensive programs which provide for implementation of the most significant scientific and technical achievements in our country. /The CAD system for electrical mashines for autonomous power generation, developed in a scientific department of the VNIIKE, (SAPR EMA), has successfully passed tests and accepted for industrial operation by the interdepartmental commission/ [boldface]. It was noted that it was developed in domestic practice for the first time and accomplished at a high scientific and technical level. /The engineering software system has been introduced into practice for research and development efforts in a number of enterprises in the country/ [boldface]. The mathematical, program and technical facilities developed as part of the system have allowed solving a broad range of practical problems in electromechanics.

A significant national economic effect has been obtained with CAD of electrical machines for various purposes. Suffice it to say that the advanced methods enable raising designer labor productivity 30- to 40-fold while reducing design cost 2- to 3-fold, and raising productivity in development and production of standard designs 4- to 5-fold.

Developing a full-fledged CAD system is considerably more complex than the object itself for the design of which the system is developed. And it would be an illusion to think that all problems have been solved here. The search continues.

8545
CSO: 1863/102

UDC 528.7:778.35:522.61:771.534:531:429:621.391:681.515.8

DATA PROCESSING CENTER

Novosibirsk AVTOMETRIYA in Russian No 6, Nov-Dec 82 (manuscript received 13 Jul 82) pp 3-11

[Article by A.A. Anistratenko, V.A. Ivanov, V.S. Kirichuk, V.P. Kosykh, Yu.Ye. Nesterikhin and N.S. Yakovenko, Novosibirsk]

[Text] The basic focus of this article is on the use of a Data Processing Center (TsOD) to solve the problems involved in the digital processing of images, although its functional capabilities are considerably broader and the areas of application are not limited to the question under discussion.

There is no doubt of the urgency of image-processing problems, particularly in connection with the development of aerospace research. Since 1969 the Institute of Automation and Electrometry has been working on the creation of electronic, optical and opticoelectronic information-processing systems that have different levels of complexity, operating speed and accuracy. The approval of these systems for the solution of specific problems confirmed their high efficiency and served as a stimulus for their integration into a unified Data Processing Center.

In connection with this, it was necessary to solve the following problems: 1) develop the structure of the center; 2) create the means for integrating the computers and the other equipment; 3) develop input, output and image-processing devices; 4) develop equipment for the recording and long-term storage of large volumes of data; 5) create systems and special software that make it possible to carry out the complete information-processing cycle.

The performance of this work insured the creation and introduction into operation of the Data Processing Center.

Structure of the TsOD. The TsOD, as shown in Figure 1, is a multicomputer hierarchical system with specialization of the computers that are part of it and the extensive use of the modular principle in both the hardware and software. The functional subsystems that are part of the TsOD are combined into a unified complex, subordinate to the basic computer, by a standardized trunk exchange system (UMSO) [1]. The functional subsystems utilize mini- and microcomputers of different capacities, depending on the technical characteristics of the devices controlled by them, and have access to all the center's equipment.

The capability of each of the subsystems to conduct its logically complete processing cycle independently makes it possible not to have to carry out the processes of

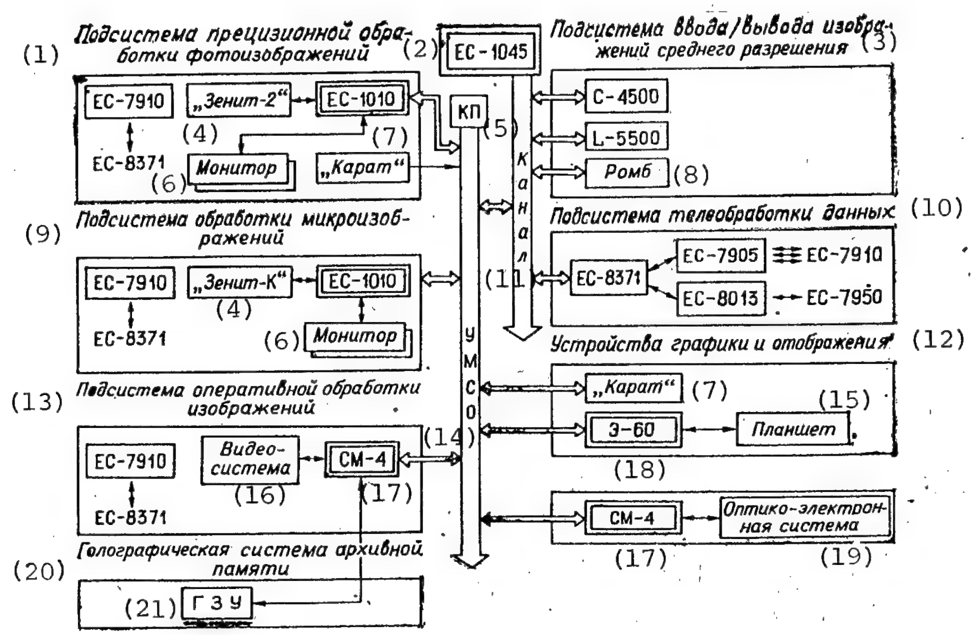


Figure 1.

Key:

1. Subsystem for precision processing of photographic images
2. YeS-....
3. Subsystem for input/output of medium-resolution images
4. "Zenit-."
5. KP [expansion unknown]
6. Monitor
7. "Karat"
8. "Romb"
9. Subsystem for processing microimages
10. Subsystem for teleprocessing of data
11. Channel
12. Graphics and display units
13. Subsystem for operational processing of images
14. Standardized trunk exchange system
15. "Planshet"
16. Video system
17. SM-4
18. E-60
19. Opticoelectronic system
20. Holographic system of archive memory
21. Hologram memory devices

creating the software and analyzing the information in parallel. The use of KAMAK equipment to control the units and provide communication among the center's subscribers (the UMSO) insures program orientation of the TsOD on the solution of various problems and does not create difficulties when it is being modernized and enlarged.

The subsystems' effectiveness, which is based on the use of modern information input, output and processing facilities and the extensive use of the dialog operating mode, has been confirmed by the solution of a number of specific problems in the interest of the country's national economy.

Composition of the Center. The facilities that have been put into operation in the TsOD include the basic computer complex, the UMSO, subsystems for the precision processing of images, the processing of microimages, input/output of medium-resolution images, graphic information depiction devices, the optical processing of images and the operational processing of images, and a holographic archive memory.

We will describe briefly the main subsystems that are oriented on the digital processing of images.

The basic computer is used to debug algorithms and programs, make the laborious computations involved in processing images, store packages of programs and large volumes of data, and exchange them with the functional subsystems. The basic computer used in the TsOD is a YeS-1045.01. The interactive functional subsystems include terminals that provide access to the basic computer from an investigator-processor's working position through a data teleprocessing system. The use of the data teleprocessing system will also make it possible to increase substantially the productivity of programmers when creating software.

The subsystem for the precision processing images includes:
a "Zenit-2" unit, in which there is an opticoelectronic scanning system with program-controlled movement of the scanning spot on an ELT [cathode-ray tube] screen [2-4], that is used to measure optical density from large-format (up to 420 x 420 mm) photographic negatives at a rate of 10^6 readings per second; this unit's resolving power is: scanning beam diameter--6 μm, positioning accuracy--1 μm;
a YeS-1010 control computer that is used to control the subsystem and carry out processing in the dialog and automatic modes;
display units: color and black-and-white monitors with a video buffer that makes it possible to store and regenerate image and that contains 256 x 384 elements;
a special processor with an adduced operating speed of 2 million operations per second that makes it possible to convolute a fragment measuring 32 x 32 elements with 16 programmable basic functions.

It should be mentioned here that the "Zenit-2" unit makes it possible to regard an image as an external computer memory of large capacity (up to 10^{10} bytes) and that this functional capability enlarges substantially the circle of problems that can be solved by this subsystem.

The subsystem for processing microimages contains a "Zenit-K" microphotometer [5] and a YeS-1010 control computer. The "Zenit-K" unit, as was the case with the "Zenit-2," utilizes a high-speed electronic-optical scanning system (the spot's diameter is 2 μm) in combination with a precision electromechanical system for movement within a field measuring 75 x 50 mm. The use of high-quality optics makes it possible to investigate micro- and macroimages with typical dimensions of several microns. This subsystem includes color and black-and-white monitors, as well as a "Karat" unit for entering information on microfilm.

The digital video system for the operational processing of information [6] is used to record, process and visualize, in real time, television images of actual scenes. It includes: a receiving-transmitting television camera with standard and program-controlled scanning; a processor of point-by-point operations and a nonlinear, amplitudinal signal-intensity converter that operates at the television scanning rate; a processor of vector operations (the time for the realization of an integrated multiplication and addition operation is 80 ns); a video buffer for several television frames with a format of 512 x 512 points and with 256 density levels; television monitors.

The system is controlled by an "Elektronika-60" computer that is connected to the main computer by a sequential channel with an exchange rate of 9.6 Kbauds.

This subsystem is the base for the creation of an automated working position for an operator-photograph interpreter.

The subsystem for the input/output of medium-resolution images contains: a unit of the "Romb" type [7], which makes it possible to enter in the computer the coordinates and optical density of image elements (the size of an element is 25, 50 or 100 μm and the maximum image format is 120 x 180 mm) and transfer information from the computer onto a photographic carrier; a "Colormation" unit for the input/output of color photographic images; a "Laserwriter" for the rapid transfer of information from the computer onto a black-and-white photographic carrier. These units are used to solve problems that do not require selective reading of fragments of images and do not have high requirements for coordinate measurement and resolution accuracy.

For the reading of graphic information, the TsOD utilizes a "Karat" unit for the operational review of graphic data and their registration on motion picture film [8]; a "Planshet" unit for the registration (and reading) of graphic information on a paper carrier measuring up to 840 x 1,200 mm, with a recording head movement rate of up to 1,500 mm/s [9].

In addition to the subsystems that have been described, the center also has: an experimental holographic archive memory system, with a total capacity of 10^{10} bits, for the long-term storage, correction, retrieval and output of large volumes of data (the principle of the organization of this system is described in [10]) and an experimental system for the opticoelectronic processing of images.

Software. Systems Software. The basic purposes of the complex of systems programs [11] are to insure the functioning of the TsOD as a whole, realize the dialog operating mode, and operate with the data base and all the center's peripheral units. At the present time, we have compiled programs that make it possible to: enter images from the "Zenit-2," "Zenit-K," "Romb" and "Colormation" units; read graphic information with the "Karat" and "Planshet" units and color and black-and-white images with the "Romb" and "Colormation" units and the monitors; exchange information among all the computers in the center; operate in the interactive mode; debug algorithms and programs.

Special Software. The center's complex of special software programs makes it possible to: restore and improve the quality of images; search for objects and determine their coordinates and geometric characteristics; follow boundaries and lines and analyze the form and structure of singly connected areas; determine the integral characteristics of fragments of images (compute the average, dispersion, histograms and matrices of transitional probabilities); carry out spectral analysis, segmentation and classification of images; realize image transformations (nonlinear amplitudinal transformations, linear and nonlinear filtration); combine images for the purpose of (for example) accumulating or synthesizing color images; carry out logic operations on two images and perform logic filtration; conduct statistical and probability analyses of given or isolated point fields.

The realized software, the dialog operating mode that has been developed, and the functionally complete set of peripheral gear make it possible to use the TsOD to work on the creation of problem-oriented packages of applied programs for the analysis of aerospace images of forest masses for the purpose of studying the spatial distribution of trees and constructing mathematical models of their development;

comparing images of geological structures obtained during aerospace surveying and ground investigations, and searching for and localizing geological formations; segmenting and classifying images, including multispectral photographs obtained with the MKF-6 camera; carrying out a statistical analysis of the morphological and densitometric properties of microstructures that are being investigated and measuring the geometric and optical parameters of isolated formations; processing astronomical photograph negatives for the purpose of determining stellar magnitudes and the relative positions of objects; recovering weak images by means of superpositioning and accumulation.

We will illustrate the image-processing procedures that have been realized with three examples.

Statistical Analysis of Microstructures. For the sake of definiteness, let us discuss the problem of obtaining the statistical characteristics of specimens of red blood.

The programs function in a semiautomatic mode. The operator's task is to select the appropriate section of the image of a specimen, focus the microlens of the "Zenit-K" unit, and preliminarily assign the initial parameters that determine the range of the dimensions and the form factor of the red blood cells. Then, without intervention on the part of the operator, the program carries out the procedures of measuring the background level and selecting the threshold level, searching for cells and determining their centers, searching for the boundaries (walls) of cells, "separating" adhering cells, rejecting artifacts, and measuring the area and transmission of a cell, with subsequent registration of these parameters.

Let us mention here that all of the enumerated procedures utilize completely the capabilities of programmed control of the scanning beam. For example, in order to search for outline points, scanning is carried out along 16 radii that form an angle of 22°30'; a contour point is one where the derivative of the transmission reaches its maximum value.

After analyzing all the cells within the scanning system's viewing field (the number of cells in the viewing field is random and ranges from 5 to 100), the program realizes a visualization mode so that the operator can select a new section and check the quality of the focus. In order for the operator to be able to monitor and intervene in the processing procedures, the entire scanning procedure is shown on a monitor. After a sufficient number of cells are measured, the results of the measurements are entered on magnetic tape (for an M-4030 computer) or magnetic disks (for a YeS-1010 computer). The total measurement time, including the operator's functions, is 2 seconds per cell; the time for automatic measurement of a cell's parameters is 0.5 s.

Investigations of random measurement errors showed that they are $\sigma_S/S = 0.034$, where σ_S = mean-square error in the measurement of the area, S = area. The measurements also contain a systematic error caused by the fact that the size of the scanning spot (2 μm) is close to that of the object being analyzed (4-12 μm). This error depends on the dimensions of the object, but does not exceed 10 percent of the area being measured.

In the complex at the present time there are data on more than 900 patients belonging to different age groups. This volume of information made it possible to carry

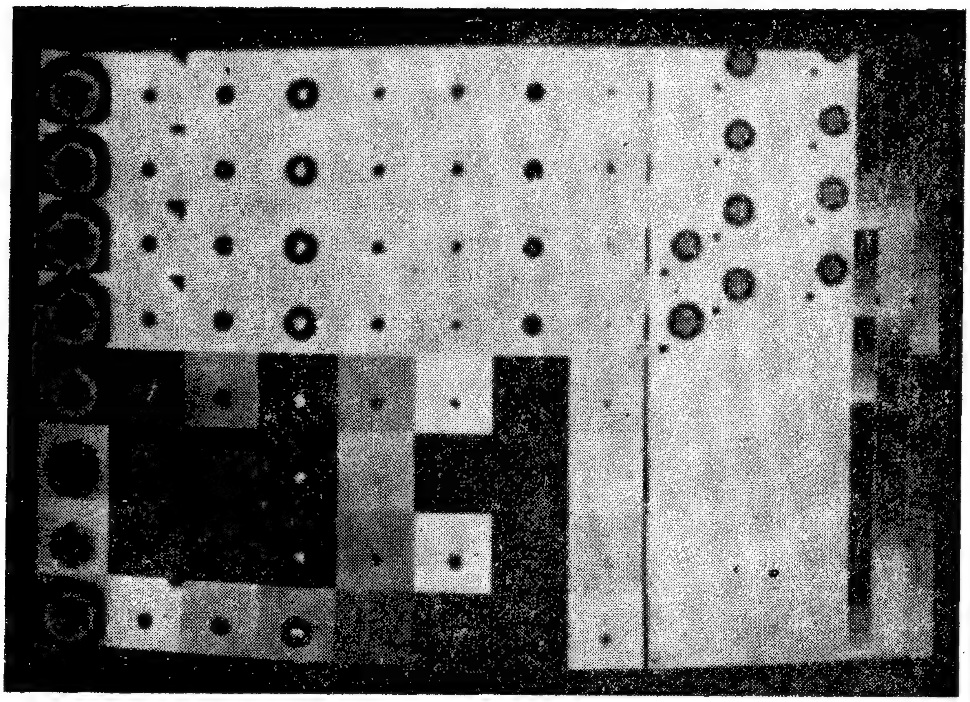


Figure 2.

out a statistically reliable analysis of the age dynamics of the concentration of hemoglobin and the dimensional characteristics of red blood cells in children [13].

Processing of Astronomical Photographic Negatives. The complex of programs for processing astronomical negatives is realized with the help of the "Zenit-2" unit. The programs function in an interactive operating mode, in connection with which the operator searches for and establishes the presence of reference stars, monitors the operation of the program, and determines and enters the necessary correcting parameters.

The complex of programs includes subprograms for: a) automatic searching for objects (manual correction is possible); b) determining the threshold level (manual correction is possible); c) finding the "gross" and fine centers of an object [14]; d) converting systems of coordinates and recording the data obtained on a magnetic carrier.

When necessary, the operator can use a program for tracking lines with the same level.

The entire operation of the implementation of the program is accompanied by a monitoring display on color and black-and-white monitors (Figure 2).

Photographic plates obtained with the help of the USSR Academy of Sciences' GAO's (Main Astronomical Observatory) 26-inch refractor have been processed. As a result,

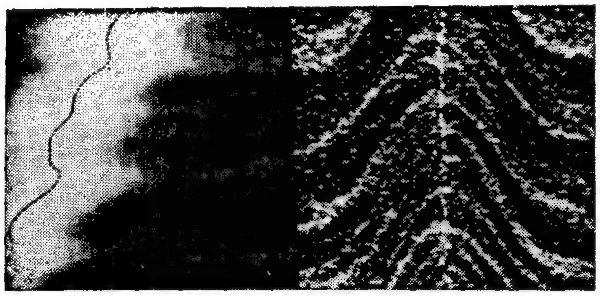


Рис. 3.

Figure 3.

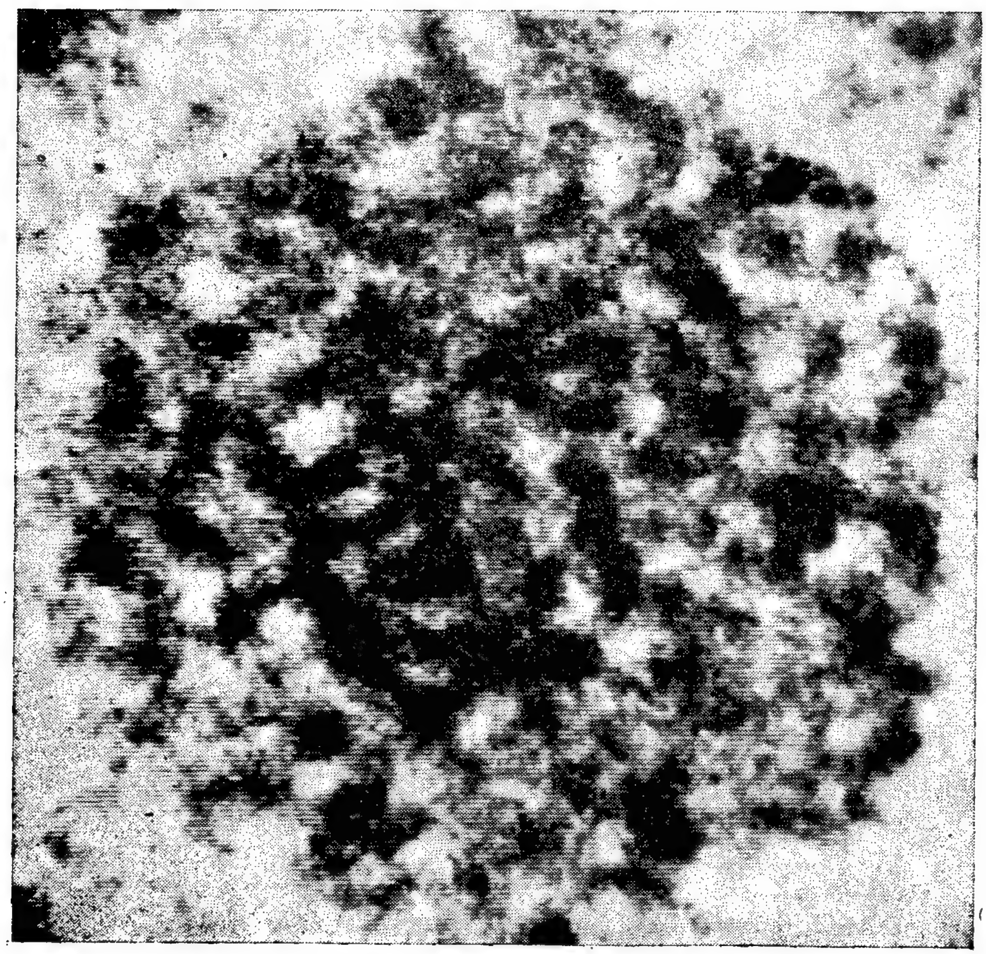


Рис. 4.

Figure 4.

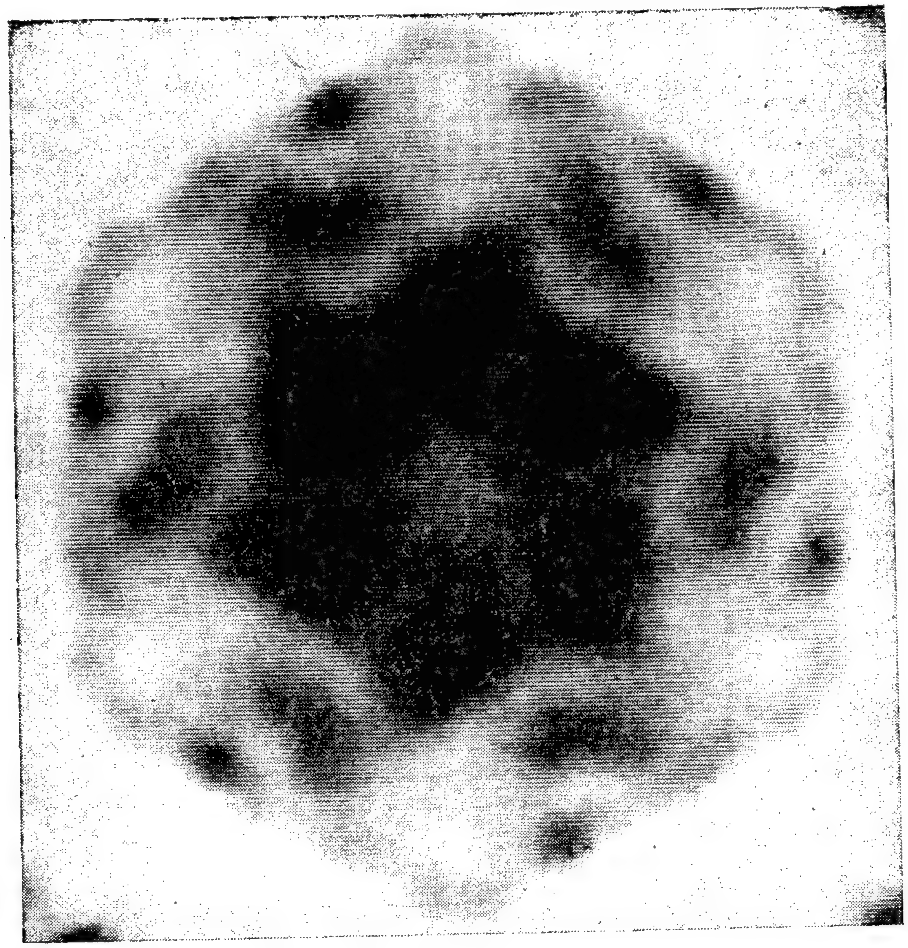


Рис. 5.

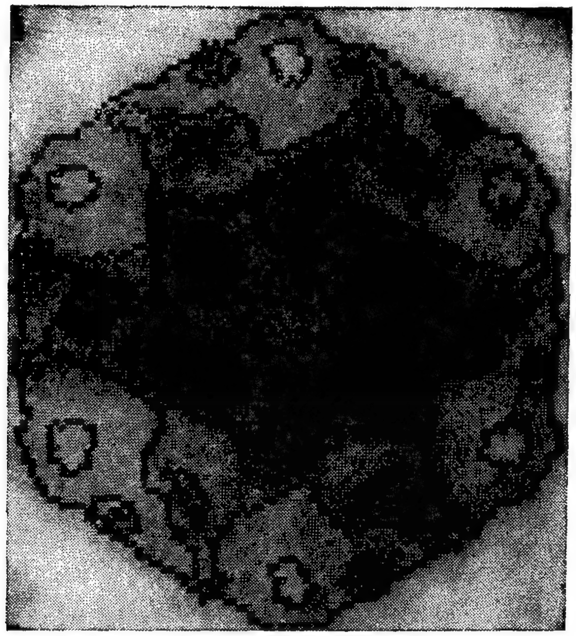
Figure 5.

it was established that the mean-square error in the measurements of star coordinates on a plate is $\sigma = 0.47$ μm; the mean-square error in the measurements of star coordinates on a series of plates is 0.82 μm (for traditional measurements this error is 1.22 μm); there is no systematic error (for traditional measurements this error is one-third of the value being determined) [15].

This complex of programs, plus the program for tracing extended lines, was also used to analyze solar spectrograms (Figure 3). The use of the "Zenit-2" unit made it possible to improve significantly the accuracy of the determination of the ray velocities in comparison with previously used methods [16].

Thus, the automation of the processes of measuring and processing astronomical negatives makes it possible to improve the accuracy and objectivity of the measurements, in addition to reducing the information-processing time (by a factor of four or five).

Recovering weak images. The complex of programs for superimposing and accumulating images, which is realized with the help of the "Zenit-K" microphotometer, was used



Puc. 6.

Figure 6.

was used to recover images obtained with an electron microscope. The physical properties of the substance being investigated limited the maximum possible dose of radiation and resulted in a low signal-to-noise ratio on the photographic plate. Therefore, high-quality images were obtained by the joint processing of a series of photographic plates with images of the same object. The complex of programs makes it possible to superimpose images (that is, to achieve the maximum of the probability function with respect to coordinates and angle), stored the combined images, and record the results obtained on magnetic carriers. Figures 4 and 5 are the original microphotograph of a virus particle and the results of averaging for 64 photographs. The superimposition program operated in the mode of direct reading of the images being combined by the "Zenit-K" unit. In connection with this, the image-combination effect was achieved by turning and moving the scanning raster, which made it unnecessary to carry out the laborious operations of turning and moving the numerical matrix.

Figure 6 shows the result of processing the combined image with cellular logic programs [17]; here the characteristic formations in the image are outlined.

Prospects. One of the basic directions for the development of TsOD's is the functional development of subsystems through a substantial improvement in the information-processing rate. This goal can be achieved by equipping the control computers with special processors of various types that make it possible to carry out monotypical operations at a speed that is considerably greater than the capabilities of the computers being used. Examples of such devices are matrix processors [18,19] and processors based on cellular logic [20].

It is necessary to direct significant efforts toward the development of systems equipment that realizes the required communications among the subsystems and the development of algorithms and programs that utilize the contemporary achievements of computer mathematics and statistics.

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ARCHITECTURE OF DISTRIBUTED MULTIPROCESSOR SYSTEM FOR AUTOMATING EXPERIMENTS

Novosibirsk AVTOMETRIYA in Russian No 6, Nov-Dec 82 (manuscript received 17 Mar 80; after revision 25 Aug 82) pp 97-99

[Article by V.M. Zavadskiy, Leningrad]

[Text] The simultaneous, coordinated operation of tens of local, multichannel, automated subsystems (LAS) is required in experiments. The units for the communication with the object (USO) of each LAS are usually distributed throughout the entire territory of an installation, at distances of tens and hundreds of meters from the computer center. In order to improve the reliability and productivity of a distributed system it is necessary to have collective utilization of the computer technology and communication lines.

Among the various types of multicomputer systems, the most efficient ones are close-coupled multiprocessor (MP) systems, communication within which is realized by a fast commutator that transmits individual access commands from the processors to the common OZU [main memory] and UVV [input/output device(s)]. The role of the commutator in a distributed system is played by the computer's MP network, which consists of MP channels of different types. The MP network contains a concentrated multiprocessor nucleus and upper-level networks that preserve the nucleus's protocol for communication with remote computers, as well as a network for the remote control of the USO's that is simpler with respect to both protocol and equipment. All the computers in such a system are logically connected to the network in an identical manner. They use collectively the common OZU and UVV and the communication lines and control simultaneously the common USO's.

The task of the MP network is to transmit access commands from the processors to the OZU and UVV so that the network for the computers and the standard operating systems is transparent; that is, so that the remote units prove to be connected directly to their own computer's common line (OSh). The most transparent network protocol insures total program compatibility with existing single-computer configurations; that is, the standard driver of a unit built into the computer must operate with the same unit in a remote location, going through the OSh interface, which is restored in another part of the network. The realization of total transparency requires insertion of the command transmission process through the network and into the cycle of the source computer's OSh and capture of the OSh's cycle for direct access, in order that the receiving computer can carry out the operation.

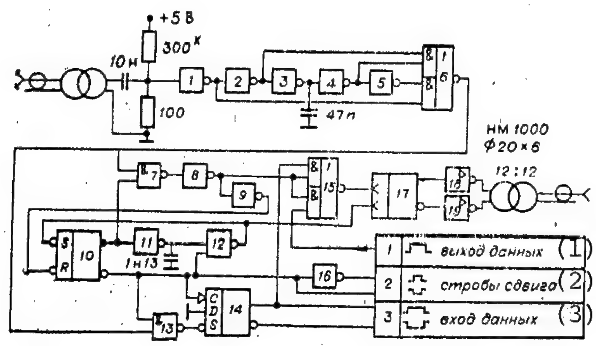
The MP network's architecture can be formulated according to the principles worked out in the seven-level model of open systems [1]. The MP network should be regarded

as a communication network that realizes the protocols of the first three levels on an equipment basis. For the MP network it is not necessary to have a traffic protocol that realizes the process of transmission of a previously formulated report. Through the network, it is simple for a computer to make use of the equipment attached to it. However, through the network it is also possible to transmit traditional reports after organizing a protocol for this on a program basis. The package in the MP network is a short one: it contains three commands, an address and data and service bits. The algorithms for transmitting signals into the lines and communication lines are located on the physical level; on the second level, there are the specific operating protocols for the MP channels, which protocols regulate package format, transmission procedures, monitoring and arbitration. The third level makes it possible to establish connections through the virtual channel (VK), which passes through the entire network, and determines the rules governing the organization and operation of the VK. This level, which is called the multiprocessor exchange protocol, determines the features of the MP network as a whole. On the lower levels, in principle, channels that are already known can operate, but specialized channels for communication with the MP protocols are required. These channels provide a high operating speed that is comparable to a computer's operating speed, so the MP mode in a distributed system does not cause processor productivity losses because of waiting for an answer.

The procedures for VK organization and recovery after errors are made are realized by the control computer. The control programs form a process, for which it is necessary to have equipment support by the facilities of the three lower levels' protocols. The VK in the MP network is a window from the computer's address space to the masses of addresses in the external registers and the OZU. The VK is organized by the mechanism of the MP network's virtual memory by adjustment of the tables of communication addresses in the channels' and computer's adapters. One of the methods for organizing the virtual memory that is convenient for complexes combinbing up to 16 computers has the following nucleus address format: OF, PA, AO and AS are address fields and 4, 6, 3 and 9 are the number of bits occupied by the fields, respectively; OF = reverse physical address of the source computer; PA = direct physical address of the receivers; AO = window address, cell number in the table of the receiver's virtual memory or the physical address of a unit in the subnetwork for controlling the USO's; AS = bias address, physical address of a register inside the window, transmitted without any changes from the source processor.

The source has several 512-byte windows. The nine low-order bits of the address form the AS. In order to establish the virtual channel it is sufficient to write the address (PA, AO) on the line of the adapter's table of addresses that corresponds to the selected output window. If the processor addressed the window, the command goes out into the network with the address (PA, AO) and the answer is returned according to the OF address. The route followed through the network by the command and answer packages is determined by the hierarchy of the physical address-Two MP networks with their own physical addressing are connected by an adapter-translator that replaces the physical addresses, which makes it possible to expand the system almost unlimitedly.

On the physical level, for the multiprocessor nucleus of the system there is a new European standard: the E3S main line, to which the network for communication with remote computers and the network for remote control of the USO's should be connected. All the networks are unidirectional and circular. Data transmission is over a



Key:
1. Data output
2. Shift gates
3. Data input

single cable, in a phase-frequency code, on a clock frequency of up to 10 MHz. The length of a regeneration section is about 200 m. All the subscribers are galvanically uncoupled by transformer filters. The figure above is a diagram of the simplest modulator, which is a demodulator based on seven Series 155 or 131 integrated circuits. This modem transmits packages going through the network with a lag time of 0.13 μs and relays them, in a sequential code, into the transceiving unit. The logic bits are transmitted over the communication line with the period of the basic frequency, whereas the zeroes are transmitted with half the period of lower frequency, which is less by half. This encoding is a variant of the method of relative phase modulation (OFM).

The upper-level SAMUR (distributed multiprocessor automation system) is the computer's communication network. The SAMUR makes it possible to carry out the initial loading and start the programs of the peripheral microcomputers, which do not have their own input/output devices.

The lower-level PILAT (sequential local automation interface) network is a simpler network for computer communication with the USO's. The PILAT-M multiprocessor variant makes it possible for several computers to work simultaneously with their USO's.

The maximum traffic capacity of these networks is 200 Kbytes/s. The network for direct access to the memory (SPDP) is used to connect faster sensors to the computer; it transmits masses of information, asynchronously with respect to the bytes, at a rate of up to 1 Mbyte/s. The marker in the SPDP is fo-med by the transmission of the OFM signal's synchronixing front.

A standard IVK-2 complex, to which PILAT and SPDP networks are connected, is now being used to automate experiments at the USSR Academy of Sciences' FTI [Physico-technical Institute]. A KAMAK kreyt [translation unknown], which is part of the IVK-2 complex, is used to connect the communication networks to the central SM-4 computer. Output from the PILAT network to the USO's takes place through a micro-main-line system, the controller of which, together with the modem, contains a total of 23 integrated circuits [2].

The information channels' protocols regulate packages in the following formats:

SAMUR: M, E, PA, T, D, OF, Z, P,
3, 1, 6, 2, 16, 4, 1, 1 (34 bits),

PILAT-M: M, E, K, A, Z, V, O, P, Ch, Ch (read command),
3, 1, 2, 12, 1, 1, 1, 16, 16 (53 bits),
M, E, K, A, D, Z, V, O, P (enter command),
3, 1, 2, 12, 16, 1, 1, 1 (37 bits),

PILAT: M, K, A, D, Z, O, Ch, Ch,
1, 1, 7, 8, 1, 2, 8, 8 (36 bits),

where M = marker; E = relay signal; PA = direct address, receiver's address; T = = type of package; D = data; OF = reverse address, source's address; Z = interrupt inquiry; P = confirmation of reception of command; K = command code; A = complete address; V = inquiry for transmission of interrupt vector; Ch = data word in response to read command; O = pause of variable length.

In order to realize the multiprocessor mode, a special signal is introduced; this is the relay signal, which goes before the beginning of the package and implements a cyclic interrogation for requests from the network's subscribers. A request that has appeared waits for a marker with a relay signal that equals zero and, replacing it with unity, occupies the package. In order to free the network, the controller issues a new marker and absorbs its own returned package.

Data transmission is monitored by comparing the transmitted and returned packages. In the read command in the PILAT network, the subscriber duplicates the data, which are compared in the command source [3].

The difference between SAMUR and PILAT protocols is that in SAMUR the command is divided into two packages that pass through the network independently. Package type T determines what is being transmitted: a command, an answer, or data. When a command is being transmitted, the command code and the register address are placed in the D field. Division of the command into two independent packages makes it possible to eliminate completely the possibility of a truncated situation during an attempt at simultaneous access from one network to another. In PILAT such conflicts can be resolved programmatically, by selecting one leading computer that has the right of access to other networks or computers.

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'MEDIUS' PROCESS CONTROL SYSTEM FOR CARBAMIDE PRODUCTION INTRODUCED

Tallinn SOVETSKAYA ESTONIYA in Russian 15 Mar 83 p 2

[Interview with Raul' Romanovich Tabast, head of sector for control systems, ESSR Academy of Sciences Institute of Cybernetics, by G. Golub in the column "From Idea to Introduction, Social Council of Scientists, Issue No 40": "Let Us Sum Up the Results: Do Not Economize on Thinking"; date and place not specified]

[Text] A group of scientific associates from the ESSR Academy of Sciences Institute of Cybernetics and industrial workers from the "Slantsekhim" production association imeni V. I. Lenin has become one of the laureates of the 1982 ESSR State Prize for outstanding work in science and technology. The prize was awarded them for develeoping the "MEDIUS" process control system and introducing it into the production of carbamide.

They accomplished complex and great work which required all their efforts over several years. The director of this group, Raul' TABAST, head of the sector for control systems at the ESSR Academy of Sciences Institute of Cybernetics, reflects on the scientific quest and lessons from the introduction in a conversation with this correspondent.

[Question] Let's begin, Raul' Romanovich, with the most "painful" question: How much time was spent on development and inroduction of the system? And could it have been reduced? I call this question the most "painful" since it is well known that the efficiency of introduction manifoldly exceeds the efficiency of scientific developments and that it is precisely on the path from the idea to the introduction where one encounters most of those subsurface and surface reefs that interfere with the implementation of many interesting developments.

[Answer] We started on the "MEDIUS" system in 1972. We analyzed alternatives for a year and selected the technology. In the next two years, we compiled the specifications and worked up the engineering design. After another year, the first subsystems were operating. Then four years were spent on assembly of equipment and debugging. In December 1980, the system was handed over for industrial operation.

Was that a lot or a little? I think it wasn't too much. We were simultaneously engaged also in the more general theoretical problems which went into "MEDIUS." And then you have to consider that we started from zero.

[Question] Why from zero? After all, you already had the work on the "Forsal" system behind you, the system which incidentally won the Soviet Estonian prize in 1967....

[Answer] The experience was useful, of course. But on the whole, these systems are not comparable. "Forsal" is a system for controlling the production of formaldehyde at the Kiviyli Shell Chemical Plant, developed if you allow in a period of general-purpose computers. The early calculations, I recall, were made on the M-3 machine at the rate of a thousand operations per second. Later, on the Minsk-22. Communication with the plant was by teletype. Once a day we received from Kiviyli data on the manufacturing process, made the computations on the computer and sent them the results. Now it seems odd recalling how primitive everything was then. Especially with the level of today's computer technology. Computers with a speed of millions of operations per second. By the way, the rates of its development are simply incredible: every 10 years, computer power increases 100-fold, i.e. in the last 30 years, a million-fold.

[Question] You mean the main difference in both of your systems is the hardware?

[Answer] Not quite. The main thing is this: /We've gone from conventional to control computers/ [boldface]. Now, at Kokhtla-Yarve, our computer is not an add-on to the processing plant for carbamide production, but an integral part of it, just as necessary and reliable as the other parts of it, and responding just as instantaneously to the smallest change in conditions. If some new apparatus is set up or new raw material is used, or if some line is disconnected for repair, all this has to be reflected in the programs that control the manufacturing process under the new conditions.

Such machines are called "built-in." A typical example familiar to everyone is the "Sirena" in Aeroflot where everything changes constantly. So the main advantage of these systems is flexibility and instant response.

[Question] But are there some general aspects to developing process control systems on the whole, irrespective of their specifics?

[Answer] Absolutely. Somehow I got the idea of comparing our developments to a pie which won't come out right if the baker doesn't put all the necessary ingredients into the dough. For us, this is thorough knowledge of the manufacturing process with all its parameters and with consideration of the required results. One has to properly choose the algorithm, the sequence of actions, compile the computer software, and finally we need the computer itself, the input/output equipment, in short, the hardware. And all this has to be implemented in the system; in doing so, one has to be able to single out the main items at the various stages of the effort.

[Question] And who specifically has to get involved, say, with developing the hardware base?

[Answer] You mean what special organization? Alas, there are none. Therefore, everything was done by ourselves. Much, and I say this without exaggerating, by our own hands, both in the institute and in the laboratory for process control systems in the combine. For example, we ourselves made the actuators from drawings

which were obtained in Moscow. The Department of Automatic Control at TPI [Tallinn Polytechnic Institute] and the ESSR Academy of Sciences Institute of Chemistry helped with advice. After all, there were so many difficulties. And with the description of the process itself--we're not chemists, you know! And with the assembly. At the plant, we had to put the computer and the control console for it in different buildings connected by a 70-meter gallery. We laid the cable and got interference: the distance was too long. We had to make an additional special program to counter the interference.... We lived for months at that time in Kokhtla-Yarve.

[Question] But when you were finally finished, weren't you sorry to leave "your own creation?"

[Answer] Sure, but the sense of satisfaction was stronger. The system came out very large (in size of programs and in documentation), it operates accurately.... Now it can get along without us--it is being developed and made more complex. Sometimes it even makes us "jealous" that they can get along without us at "Slantsekhim" [Shell Chemical]. But we still have contacts with the plant and help them when necessary.

[Question] And what are your future plans? New, more complex control systems? Or improving on what has already been done?

[Answer] Well, after the carbamide production process, we're no longer amazed at complexity. I will allow myself to compare our system (perhaps it is somewhat audacious, but quite appropriate) to a system for controlling the flight of a spaceship. In the movement of a body in space, the system is constantly based on the six coordinates of its position. But in developing the chemical process control system, we had to contend with hundreds of input data items.

As for our future plans and current tasks, we're working on /developing a system of computer-aided design [CAD] for control systems/ [in boldface].

[Question] That is, you want to make recommendations as a whole, without regard to the manufacturing process features of the systems. But in that case, will those who use the systems be spared of their own searches for solutions, won't they have to waste time on this?

[Answer] They will have to. But this is unavoidable, even if we ourselves with our experience were to take on some new process, or "pie" as we call it in jest. For example, we recently received a request to develop an automated control system for a milk combine from the PKB [planning and design bureau] of the ESSR Ministry of the Meat and Dairy Industry. We declined to bake their "pie" since it would simply be more difficult for us than they themselves to get into the details of the technology. But we prepared for them a thick survey report on possible alternatives for the future system, we will be consulting with them and also perhaps develop some parts of the system. In the ideal, each industry should have its own such groups. We consider this way economically more efficient since with such a distribution of efforts we will be of greater use to the national economy. So that now our aim is to incorporate our experience into facilities for designing that are suitable for many purposes. And we have the conditions for this: 22 highly skilled associates and 7 mini and micro control computers.

[Question] Anyhow, for those who are just getting into development and introduction, based on your experience, what advice would you give them? What lessons have you learned?

[Answer] The main thing is to /get the industrial workers interested beforehand in their own development/ [in boldafce]. At Kokhtla-Yarve, we started out with a situation almost ideal: The project was initiated by the plant itself, by its former general director, N. D. Serebryannikov. It was supported, understandably, by the whole management staff. We were very fortunate that Mayya Zakarova, a programmer at the enterprise, took a great interest in our plans; without her, it would have been difficult to achieve anything; she became a system developer and now works with the system. But in the carbamide shop itself, we had to literally win over supporters. Until an operator sat behind the control console that allowed him to see the entire manufacturing process without getting up, it was difficult to convince him that we were working for his benefit.

[Question] And so you have to wait until the project gets to the console? After all, that is already as a minimum the middle of the development....

[Answer] You don't have to wait for the console. We suggest now the way of a system of prototypes, i.e., we artificially create a situation in which a person, even a nonbeliever, can appreciate the merits of computers.

For example, helping now the specialists from the Planning and Design Bureau of the Ministry of the Meat and Dairy Industry, we purposely sat one of them down at a computer and asked him to "accept" a tank of milk in the form that is usual for him. Using the console keys, he asks for, as prescribed, the number of the tank, the fat content of the milk, etc. And he gets the required answers on the display screen. Until he notices an absurdity: In some machine answers, tons and meters were confused. This absurdity was especially programmed by us, so that the person is more attentive "in talking" with the computer. Together we correct the error and refine the algorithm. The aim is achieved: the person is compelled to associate with the machine. But if you ask him before about forms of interaction with the computer, he wouldn't understand what we are talking about.

Of course, this "game" has to be prepared in advance. But it pays for itself.

Some more advice for those who are going down the thorny path of developing such systems. /Don't rush in the first stage of development, and don't economize on thinking and analysis/ [in boldface]. Perhaps this sounds paradoxical. But a mistake or inaccuracy covered up somewhere in the very beginning of the effort will nevertheless make itself felt. And the more done by this time, the more difficult will changing it be.

Of course, our way was not optimum. While developing and introducing the control system, we, as in the handicraft industry, had to do everything ourselves. It would have been more efficient to distribute the functions after including specialized organizations in the effort. One would describe the manufacturing process, another would compile the programs, a third would manufacture and assemble the hardware complex. That's exactly how it's done in progressive firms. But so long as we don't have this, /it is necessary to establish groups for introduction in

each sector. This is the real way. And also: It is very important for such systems with "electronic filling" to be incorporated now in designs for future enterprises in which they will be operating/ [in boldface].

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AUTOMATED SYSTEMS OF FINANCIAL-CREDIT ORGANIZATIONS DISCUSSED

Moscow FINANSY SSSR in Russian No 3, Mar 83 pp 34-38

[Article by director of IVTs Minfina RSFSR, candidate of economic sciences B. I. Filimonov; deputy director, candidate of technical sciences A. P. Kolesnik; deputy director of the computer center of financial and insurance organizations of the Gorkiy oblast V. I. Lapshin; and deputy chief of the state profit department of the financial department of the Gorkiy oblispolkom V. V. Malev: "Questions of the Interaction of Automated Systems of Financial-Credit Organizations"]

[Text] Creation and introduction of an automated system of financial calculations [ASFR) began in the Minfin Federatsii in 1978, with operation of the republic's information-computer center (IVTs). The center works in three directions: research on key scientific and technical and methodological questions of creating the ASFR and "ASU-Gosstrakh"; design and introduction of tasks; and creation of computer centers for the financial and insurance organizations of the RSFSR, and coordination of their work.

An analysis of the basic tasks shows that the ASFR of the Russian Federation is a very large and extensive system having a complex structure. A technique was thus chosen of system design by incremental tasks and their complexes, while observing a strict system organization of design.

The Russian Federation is the only union republic where the Minfin IVTs has its own network of computer centers, created together with Glavgosstrakh RSFSR. The IVTs currently plans and coordinates the work of nine computer centers of the republic's financial and insurance organizations, directs development of complexes of tasks in the ASFR department and "ASU-Gosstrakh" and the collective-use computer center (VTsKP) of the Sverdlovsk oblispolkom and the ASFR department of the scientific production association "ASU-Moskva", and coordinates ASFR work in the IVTs of the Leningrad oblispolkom. The IVTs works out long-range coordination plans; examines annual computer center work plans; holds coordination and topical meetings; regularly checks production-financial activity and makes subject checks; and provides practical assistance.

The technical base of the Minfin RSFSR IVTs are two "Realite" computers and a leased YeS [Unified System] computer. IVTs workers have studied the possibility of using the "Realite's" in the remote access mode. Experiments on creating remote subscriber stations consisting of a display and printer were performed for

this purpose. Such stations were set up and tested at Mosgorfinupravleniye and Mosoblfinotdel 5-6 km from the computers, with communication by a switchable telephone channel. The experiments showed the feasibility of creating an ASFR base in these financial organizations with minimal capital investment.

Interaction of the automated control systems of financial-credit organizations was a primary subject of IVTs research.

The directive of the CPSU Central Committee and USSR Sovmin No 695 imposes new requirements on the automated systems of ministries and departments. One of them is to provide interaction and integration of these systems for rational combination of sectoral and territorial economic development, and supply prompt, reliable information on economic processes in the economy to directing organizations of all levels. Automated systems of planning and financial-credit organizations must play an important role in the interaction; they are primarily responsible for intersectoral coordination of the work of ministries and departments. Financial-credit organs have all the data on enterprise activity; they monitor it, participate in reviewing the enterprises' industrial financial plans, and are directly connected with the planning organizations. A large volume of information is currently concentrated in Gosbank institutions on the work of enterprises and organizations, but other organizations do not use this information adequately.

Bank data exist not for their own sake, but for the operation of the enterprise, organization, and sector. A necessary part of the production process, they are created and processed for its needs. The result is their high reliability. The technique for processing them has also been polished together with other production functions, resulting in their low cost. Financial organizations are interested in Gosbank information first of all because its institutions do the books on accounting execution of the budget, and secondly to monitor the financial and economic activity of enterprises, organizations and institutions. With the current interaction system, Gosbank and Stroybank institutions at all levels--union, republic, oblast and rayon--periodically present aggregate accounting and report data to financial organizations. These interrelations are already insufficient due to the development of automated systems, and fail to meet the need for information required for economic management. Above all, the ASFR's now need not aggregated data, but more detailed data, since a more thorough analysis of all indices is done using the computer, and they are not hard to aggregate. In other words, information exchange in automated system interaction must be expanded.

Moreover, up till now the form of data exchange has corresponded to their human perception; they have been transmitted as paper documents. Data between automated systems must travel on machine carriers (magnetic tape, for example), or by channel directly from one computer to another.

At the present time, and even more so in the future, increasing attention must go to complex tasks of simulating economic indices and processes and to tasks of planning, as automation of the simplest and most widespread computer work in automated systems is completed. This means that the quality of the indices used in the system must rise.

Integration of automated systems of financial-credit organizations must not increase the flow of documents or generate intermediate documents. This can be done by using initial payment documents as the initial data.

A coordinated technical base must inevitably be created in the process of developing the interaction of ASFR's and OASU-Gosbank. This is a complex problem from both the technical and the organization standpoint.

Let's look at the directions of interaction of automated systems of financial-credit organizations in greater detail. Several preconditions currently exist for it.

Financial-credit organizations and their automated systems have an identical structure of four levels: union; republic; oblast; and rayon. At the republic level are the republic computer centers of Gosbank and Stroybank, as well as the IVTs of ministries of finance of the union republics. At the oblast level, in Gosbank and Stroybank have been created multiple-user computer centers serving institutions of nearby oblasts. ASFR tasks at this level are solved in several administrative units at the computer centers of financial and insurance organizations of autonomous republics, krays and oblasts. At the rayon level, Gosbank and Stroybank subdivisions have subscriber stations linked by channel with the computer centers at the oblast level; proposals for their creation are handled at the rayon financial departments. Each level has multi-sided interconnections of financial organizations and institutions of the bank.

The technological problems of interaction are completely manageable. Although the technical base of different automated systems differs in many ways, it is not an insuperable obstacle to data exchange by machine carrier or channel. The order and legal aspects of data exchange on machine carriers between automated systems have been clearly defined by the directive of the USSR State Committee for Science and Technology of 20 April 1981 "On Giving the Force of Law to Documents Created by Computer Means."

The oblast and rayon levels in ASFR's and OASU-Gosbank should be developed as a single entity. Rayon level information in both systems undergoes a certain initial processing, and is transmitted to the higher level's computer center and the appropriate financial or credit organs. There is currently no information communication between computer centers alone; other organs of the finance and credit systems operate inefficiently between computer centers. Much of the budget fulfillment information actually goes from the enterprises (institutions, organizations) through the rayon divisions of Gosbank to the computer centers of the oblast office. It is there checked, corrected, stored, processed and returned to the rayon level, where some of it is transmitted to the rayon financial department. Data travel a similar route in financial organizations from the rayon to oblast level. Where there are two information flows, with information already stored on computer in Gosbank organizations being transferred in financial organizations to a machine carrier (punch cards, magnetic tapes), a large expenditure of manual labor is inevitable.

At the republic level, information interaction with Gosbank and Stroybank can initially be reduced to transmission on machine carriers of, for example, reports on cash fulfillment of the budgets, as defined in the plan developed by the IVTs of Minfin RSFSR "Conversion of Monthly Report Information by Mosbank and Stroybank to a Form Designed for Use in Equipment of the RSFSR Ministry of Finances; and Compilation of Monthly Reports on Fulfillment of the RSFSR Republic Budget."

The computer center of financial and insurance organs of the Gorkiy oblast has developed a design for integrating ASFR's with the OASU-Gosbank for the oblast and rayon levels, under the direction of the IVTs of Minfin RSFSR. It includes transmission of existing information from the computer center of the oblast office of Gosbank to that of the financial and insurance organs of the oblast, and performing a daily accounting on its basis of arrival and disbursement of funds in the financial organizations. It also provides for expansion of the quality composition of information used by financial-credit organizations, while developing the appropriate hardware and software.

In 1982, experimental use was coordinated with Gosbank of a task to record arrival of the turnover tax and transmit the appropriate information from the computer center of the Gorkiy oblast office of Gosbank. The hardware and software for this task had already been worked out in the computer centers of the oblast office and of the financial and insurance organs of the oblast, and been approved by the oblast, city and rayon financial departments. According to the document signed by Gosbank, the experimental use went for five months, starting in May 1982. Afterwards, the possibility will be studied of expanding this experience in the Gorkiy oblast and extending it to other financial and credit organs of the RSFSR.

We feel that interaction should start with some important operative index; the turnover tax was chosen. The experiment in Gorkiy in 1981-1982 went as follows.

Information from rayon divisions is transmitted to the computer center of the Gorkiy oblast office of Gosbank via teletype. Information from all documents on payments to the budget is stored in the oblast office computers at the end of each day. The personal account numbers in Gosbank divisions, contained in the "Ural-14" computers of the oblast office computer center, include the Gosbank symbol coding the type of payment. The symbols correspond to the budget classification subdivisions. A program was written for the "Ural-14" to analyze the personal accounts and single out those corresponding to a certain type of budget payment; for example, the turnover tax. Information on primary payment documents for this tax is put on a punch card from the computer at the computer center of the Gorkiy office of Gosbank. Three to four minutes are spent to generate the data for one rayon. For reliability, the data on the punch card are accompanied automatically by check sums. The punch tape with the payment document information is sent each morning to the computer centers of the oblast financial and insurance organs, where it is loaded on the YeS-1033 computer, adding to the data base. The refined turnover tax plan is stored here. It is thus possible by 11 o'clock each morning to analyze turnover tax plan fulfillment by rayon, sector and payer, transporting analytic tables to the rayon financial departments.

We thus realize the above principles at the first interaction stage: improvement in the technology; expansion of exchange; and use of initial payment documents as the foundation for the information base. Moreover, the Gorkiy experiment is only beginning the first stage of ASFR and OASU-Gosbank interaction. Information could obviously be carried in this way not only on turnover tax receipts, but also on other enterprise payments and financing from the budget, and on execution of its profit and expense parts. This would enable much better financial organ management of the budget fulfillment, first through faster receipt and better analysis of reliable data, and second because of their receipt with almost no manual labor, freeing time for basic economic work.

The information in the computer can also be used to formulate all reporting documents of the oblast financial department; in particular, all statistical report forms on state profits and monthly and quarterly reports on budget fulfillment. Their preparation in the ASFR's will also not require large additional labor costs.

By solving technologically the question of data transmission on carriers, we thus obtain a noticeable savings without altering the existing order for accounting and reporting at enterprises and organizations.

What place do the bank data occupy in the information base of the ASFR "State Income" subsystem? An analysis of the hierarchy of indices of this subsystem's accounting, control and reporting block showd convincingly that if each budget payer has a personal account in the information base corresponding to his payments, then its structure will be sufficiently simple and standard for all the subsystem's accounting and report tasks. This has been tested at the computer centers of financial and insurance organs of the Gorkiy oblast for local tax tasks and tasks of recording turnover tax receipts.

This means that after working out the first stage of interaction with OASU-Gosbank the ASFR data base at the oblast level should provide for management based on bank information of the personal accounts of all budget payers in all enterprises, organizations and institutions financed from the budget. Exchange volume reaches several thousand initial documents per day (or rather, not the documents themselves, but their information). It is thus necessary to move from the punch tape used in the above experiment on recording and analyzing turnover tax receipts to using a magnetic tape or setting up direct channel linkage between computers.

Assume that these problems have been solved. What direction will further development of the interaction of automated control systems of finance and credit organs take? Two routes are advisable: mutually coordinated development of the technical base at the oblast and rayon levels; and expansion of the quality of the data used.

There is currently practically no technical base at the rayon level in the ASFR of the Federation. At the OASU-Gosbank are complexes at this level that prepare and transmit data on dedicated channels to computers at the oblast level computer center. Data are not processed at the rayon level; they are concentrated in the oblast unit, placing a heavy load on communication channels. For example, in the Gorkiy oblast the Gosbank "rayon-Gorkiy" communication channels are leased from 8 am to 5 pm, and are in use about half of this time. In connection with transition to the unified computer system, Gosbank is working out new, specialized peripheral complexes consisting of concentrators with terminals and printers connected to them. As before, the basic computer work is up to the computer-equipped computer center at the oblast level.

Considering the universal microcomputers created in recent years, an alternative version of constructing a rayon computer network can be suggested. All the computer work is divided into two parts. Initial processing of indices is done at the rayon level; as a rule, they are transmitted to the oblast level in aggregate form. The data must be transmitted via a communication channel between computers of different levels. But transmission of primary indices according to the corresponding inquiry must also be provided to ensure operation of the information-reference system.

The SM-1800 microcomputer is perhaps the most commonly used at the rayon level, from the standpoint of both the devices connected to it and its hardware. Complexes based on it can have up to nine alphanumeric display terminals, up to four memories with interchangeable floopy disks with a total capacity of 1 megabyte, and a printer, SM-1800 hardware allows simultaneous work by several users in a dialogue mode. A goal should be that there will be not a professional operator at the terminal, but an economist from the Gosbank or rayon financial department. This will ensure efficient operation of the complex and require additional operating expenses only for microcomputer servicing. Automated work sites based on the SM-1800 must become a powerful and reliable instrument in the economist's hands. The IVTs of Minfin RSFSR already has three years of experience in developing and introducing economist-oriented software for solving economic problems in a dialogue mode. It indicates that such complexes ensure effective and complete control of loaded information, on-line acquisition of results, a reduction in the number of paper documents, a 2-3 fold drop in the volume of manual labor, and a substantial improvement in work quality. Intermediate technological stages characteristic of the batch mode are also eliminated: document transport; information transfer to a machine medium; error removal and introduction of corrections, etc. The user is interested in the final results of calculations, faster and of better quality. Besides, it is almost impossible to solve certain on-line problems in the batch mode using operators (recording changes in planning indices and open credits, mutual accounting between budgets). Software complexes used in the central apparatus of Minfin RSFSR and Glavgosstrakh of the republic have proven themselves. Introduction of this technology at the rayon level is promising, and even the only possible alternative, since adding operators to the rayon financial department staffs is unfeasible.

Regarding the distribution and integration of hardware at the rayon level, the following variant is evidently the most feasible. Each rayon financial department or Gosstrakh inspection center has its own microcomputer with the required configuration of peripherals; exchange with the oblast level computer center is via a single shared channel. Theoretically, it is economically and technically advisable to use this channel for such exchange in conjunction with the Gosbank division. In the scheme proposed, data on cash fulfillment of the budget will be transmitted to the financial organizations at both the rayon (initial document data) and oblast (aggregated data) levels. The design of hardware for rayon financial and banking organizations should thus provide for their compatibility from the standpoint of data exchange on a magnetic medium or by channel.

Such a variant of constructing the technical base for financial and credit organizations at the rayon level assumes further integration of the corresponding automated systems and, in our opinion, is the most feasible, although serial SM-1800 microcomputers could also be used in Gosbank departments.

The above order for using bank information in the ASFR's provides management of the personal accounts of enterprises, organizations and institutions. However, correct planning and better accounting of production and consumption of goods and services require that purely financial information be supplemented with data on goods and services in natural terms. An analysis of various forms of non-cash settlements by Gosbank, such as acceptance, letter of credit, commissions, plan payments or checks, shows that some payment documents already have the required

data. For example, there are two parts to the invoice (request) used on the acceptance form: specification (upper part), and the payment request itself (lower). The latter, by means of a coding system, defines the payer and his Gosbank department, date and number of the operation's document, type and nature of operation (by Gosbank classifier), and total involved. The upper part of the invoice has information on the product: its code, quantity, price, list price, cost, and data on discounts and packaging. Having such information on all product types and storing it in the computer, it is possible to obtain a complete, reliable picture of a region's production and consumption (e.g., in an oblast), with differentiation by time, location, type of good, and quantity of goods sent and received. The result is an enhanced capability for on-line control of these processes. An information base will be created for planning. This issue was considered in V. D. Belkin and V. V. Ivanter's "Management Organization and the Bank" (Moscow, 1968). Comprehensive data on financial operations and goods and services can be used not only in the automated control systems of financial and credit organizations, but also in automated planning calculation systems, state statistics, supply systems, and sector ASU's, all having one reliable source of information: initial payment documents.

It follows from the above discussion that creation of a complete and unified information base of financial and credit organizations implies standardization of payment documents, so that they contain both financial accounting data and standardized economic information on the material basis of operations performed. Since the overwhelming majority of enterprises have either computers or automated accounting equipment producing payment documents, it is possible to organize transmission to the Gosbank division of all data on a machine medium together with the document itself. This will involve almost no increase in manual labor costs for producing the initial documents at the enterprises, which is especially effective for large-scale enterprises.

Improving the quality of indices used in the ASU's of financial and credit organs is a promising but difficult task, especially from the organizational standpoint. Interaction and integration of automated Gosbank systems hold out the promise of a significant economic savings. The technical and organizational problems can be resolved in stages.

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AUTOMATED CONTROL SYSTEMS IN MOLDAVIAN AGRICULTURE DISCUSSED

Kishinev SEL'SKOYE KHOZYAYSTVO MOLDAVII in Russian No 2, Feb 83 pp 9-11

[Article by V. Moroz, sector chief, and T. Platonova, senior scientific associate and candidate of economic sciences, NIIEiOSKhP MSKh MSSR: "Development of ASU's in Moldavian Agriculture"]

[Text] The main effect from using ASU's [automated control systems] lies in rationalizing the management process, raising its quality, efficiency and the validity of management decisions, which ultimately leads to a growth in production efficiency.

It has been proposed that ASU's be created in all ministries and departments involved with agricultural production. This requires coordination with the automated system of state statistics (ASGS) of the Central Statistical Administration of MSSR and the ASU's of several other ministries and departments of the republic's agro-industrial complex.

The agricultural automated control system is currently being created and introduced only at the republic level. The first ASU stages have gone into operation and are operating successfully at many ministries and departments.

However, there are several shortcomings in the creation and introduction of ASU's. ASU development has practically ceased in the system of the MSSR Council of Kolkhozes. Work is not being performed here to create republic-level ASU's. Design of the ASU for the Chadyr-Lungsk rayon council of kolkhozes, begun in the 9th Five-Year Plan, was soon halted due to the low design quality. It should be noted that attempts to create automated control systems generally at the enterprise and association level in the republic were unsuccessful. Lack of appropriate scientific studies was a factor, as were significant planning miscalculations. For example, in creating the ASU of the "Bul'boki" swine-breeding complex, annual fund allocations were less than 20-25% of the required amount.

Lack of coordination of design work is probably the main shortcoming in ASU development. Several organizations produced ASU designs in the period just ending. The main designer for the MSSR Ministry of Agriculture is the Republic Agricultural Computer Center. The special design bureau ASU-Soyuzpishcheprom is designing automated control systems for Ministry of Fruit and Vegetable Growing, Ministry of the Foodstuffs Industry and republic agro-industrial associations. Other

organizations are also involved in agricultural ASU design, including some with little connection to agriculture.

No one is coordinating design of departmental ASU's. This has resulted in a rise in design costs stemming from duplication of effort and a drop in design quality. Systems created are incompatible. Incompatibility at the software and information level is also found between agricultural ASU's and ASPR's [automated control system for planning calculations] and ASGS's [automated system for state statistics] developed by intersectoral systems.

It is generally believed that ASU development is accompanied by introduction of econometric methods in planning practice. This does not seem to be true with respect to the MSSR agricultural ASU. An analysis of the tasks it solves shows that most of them consist of compiling and analyzing statistical reports.

Some of the tasks classified in the planning subsystem actually automate the analysis functions. ASU operational experience has shown, however, that using optimal planning methods enables a 5-10% improvement in efficiency indices (profits, net income, etc.), compared with variants calculated by the usual methods.

The republic agricultural computer center of the MSSR Ministry of Agriculture has mastered a set of programs and the technique for solving optimization problems on the YeS-1020 computer. This system has been used to solve plan optimization problems at several sovkhozes and associations, but general introduction of the system is hindered by the lack of trained personnel and the existence of departmental barriers.

There is a similar situation with the use of correlation-regressive methods in analyzing agricultural production. These methods have become widely used in the agricultural ASU's of the Soviet Baltic republics, where bulletins containing an analysis of production cost of the basic forms of production, gross income, etc., are sent annually to agricultural enterprises and organizations. Such analysis is done in our republic basically by traditional methods. Use of correlation-regression methods is irregular, and analysis is generally much more modest. Moreover, none of the departmental ASU's can systematically provide management organizations with the required analytic developments in the republic's agriculture!

This is due to the incompleteness of the agricultural ASU software subsystem. Most tasks have their own information fund. Information loaded in the computer is often used only once, yet it is known that the greatest machine time costs for economic problems occur with loading and checking of information. Formulating data files to solve individual tasks is comparable in labor cost to processing information on keyboard machines. The computer can only be used efficiently given data files permanently stored on machine media. Such data files can be organized when creating data banks.

In our republic, formation of data banks for the agricultural ASU is in its infancy. Each ministry and department formulates data files in accordance with its own interests. Agricultural information is centrally stored in small amounts

only at the Republic Computer Center of the MSSR Central Statistical Administration.

The decisions of the May (1982) Plenum of the CPSU Central Committee single out the agro-industrial complex as a planning and management subject, thus raising the importance of timely provision of management organs with information on the development of APK [agro-industrial complex] sectors. With respect to the automated agriculture control system, this means creating a unified data bank. In the long term, creating a data bank for all sectors of the republic's APK is advisable.

Effective resolution of the problem of developing the republic's automated agriculture control system requires a certain reconfiguration of the organizational structure. There must be transition to an advanced form of organizing the use of computer technology by the collective-use computer center. Collective use of computer resources makes it possible to raise computer utilization, lower hardware procurement costs and reduce data processing costs, while creating the possibility for speeding up designs and centrally introducing standard design solutions. Determining software dissemination will also reduce ASU costs, and allow more effective use of a unified national fund of algorithms and programs.

Such computer centers are operating successfully at the republic level in Estonia and Belorussia.

The issue of organizing a collective-use computer center has already been discussed in the Moldavian press. We feel that a collective-use computer center of sectors in the republic's agro-industrial complex should be created based on the Republic Computer Center of the MSSR Ministry of Agriculture, computer center of PNO Moldsel'khozkhimiya, special design bureau ASU-Soyuzpishcheprom, computer center of Goskomsel'khoztekhniki of the MSSR, and Republic Computer Center of the MSSR Central Statistical Administration.

Further ASU development should expand work not only at the republic level. In the long run, they must also be created at the rayon management level. The previous idea of creating ASU's at the rayon management organization level based on large and medium computers should be reconsidered, due to the fast development of computer hardware in recent years. The appearance of simple, inexpensive micro- and minicomputers opens up new possibilities for solving ASU tasks in kolkhozes, sovkhozes and other enterprises and associations.

Minicomputers significantly lower data processing costs and raise the reliability of the entire ASU, since the breakdown of one of the computers does not greatly affect the overall system operation. However, the issue of combining centralized and decentralized data processing has not yet been studied in the republic. We are lagging behind other regions of the country in using mini- and microcomputers.

Another aspect of the problem of developing the agriculture ASU should also be pointed out, that of personnel. The demand for ASU personnel stems from the need for workers in the management apparatus, computer centers, design and scientific research organizations, and specialists in the planning-economy services of ministries and departments, whose work directly involves ASU design, introduction and operation.

It is this shortage of qualified personnel that is slowing down introduction of econometric methods in agricultural production planning and analysis. The uneven staffing of various ASU levels should also be pointed out. Computer centers generally have enough programmers and hardware operation engineers. The situation is much worse for specialists in formulating, developing and using ASU tasks: econometricians, of which there is a shortage. Yet they are the ones to provide the link between the control apparatus and the computer.

In view of the fact that the republic's higher educational institutions are not training econometricians to work in agriculture, it would obviously be advisable to provide for their training in such institutions of other republics of the country by means of special certificates of qualification. Retraining of economists at departments for raising skills should also be expanded at the appropriate institutions.

Creating the automated agriculture control system is a complex, multi-faceted process, which cannot be separated from the tasks of improving management of the republic's agro-industrial complex. Putting it at the service of the republic's agriculture means expanding the range of use of modern computer equipment, speeding up management decisions, and raising their soundness.

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TASKS OF CENTRAL STATISTICAL ADMINISTRATION'S COMPUTER SYSTEM DISCUSSED

Moscow VESTNIK STATISTIKI in Russian No 3, Mar 83 pp 41-46

[Article by S. Bushev, director of the GUVR TsSR SSSR [USSR Central Statistical Administration], candidate of technical sciences: "Tasks of the TsSU SSSR Computer System in the Current Year"]

[Text] The entire country is now working on fulfilling the decisions of the November (1982) Plenum of the CPSU Central Committee, and realizing the State Plan for the USSR's Economic and Social Development for 1983. State statistics occupy an important part in them, including mechanization and automation of statistical and accounting work.

It should first be pointed out that all the enterprises and organizations of the TsSU computer center have fulfilled their 1982 planning tasks for the basic indices. For example, the work volume plan was fulfilled by 102.6%; labor productivity grew by 3%; and the average wage grew by 0.7%. The labor volume basically increased through greater productivity. The next step forward has been made in realizing the TsSU measures to further improve state statistics, stemming from the decisions of the 26th CPSU Congress and the May (1982) Plenum of the CPSU Central Committee.

We shall not the main results of the TsSU computer network's activity in its main development directions.

A primary task for the TsSU computer system is to create the third stage of the automated system of state statistics (ASGS). The TsSU system currently has 137 complexes of electronic data processing (EOI) in operation, including 36 system and 101 union ones.

Bringing several complexes into industrial operation has shortened the time for working out statistical reports. For example, completing the report for form No. 1-tp, "Basic Operating Indices of the Industrial Enterprise" (annual, system) has been shortened by 2.5 months; for form No. 18-3n (annual), "Report on Fulfillment of Socialist Obligations in Material Resource Conservation", by 30 days; processing materials from budget monitoring in groupings, by 60 days, etc. There have been worked out and approved 18 technical assignments for developing and creating ASGS functional subsystems, and work programs for 18 statistical sectors.

Automated data banks (ABD) and remote statistical information processing systems (STOSI) are important in the software. By the beginning of 1983, transition of the ABD software from a DOS unified system to an OS unified system has been completed. The first practical results have been obtained from using the STOSI on Moscow-Tallin-Minsk-Kiev sections.

National classifiers of technical-economic information are used in working out statistical information. There is an interaction of several ASGS subsystems with corresponding ASPR [automated control system for planning calculations] subsystems and other automated control systems for 16 EOI complexes. Several experiments have been performed on methods of statistical task processing with small volumes of information based on modern microcomputers. Work on creating an experimental rayon distributed computer system continues.

The organizational structure of the TsSU computer network has not basically stabilized, corresponding to the administrative-territorial division of the country, including union, republic, oblast and rayon levels. There are a total of some 3,000 computer organizations (computer centers, stations, etc.) in the TsSU system. Computer centers of the union, republic and oblast levels have Unified System (YeS) computers, PVK M5000 (10, 100) minicomputers, "Robotron" and "Iskra" microcomputers, and a large stock of punch, small electromechanical and keyboard machines. The load for all machine types was standard in 1982.

The organizational stage has also been completed in a special integrated scientific and technical program to create the first stages of 10 new collective-use computer centers (VTsKP) and develop those created in the 10th Five-Year Plan. The working plan for their creation was worked out and approved; design was organized of data transmission channels by USSR Minsvyaz' organizational staffs; overall planning, provided with the necessary resources, was initiated; and in general, the problem of creating their material and technical base was resolved. An integrated program for developing and reinforcing the material and technical base for the rayon portion of the TsSU computer network was worked out and approved.

Besides fulfilling the basic task of collecting and processing statistical information, the computer centers and stations of the TsSU system served some 91,000 enterprises and institutions of the national economy. Special attention was devoted to introducing KMBU: complete accounting mechanization. For example, it has been introduced in all the agricultural enterprises of 26 Latvian SSR rayons.

In executing the decisions of the May (1982) Plenum of the CPSU Central Committee, a good deal of organizational work was done to better introduce complete mechanization of accounting in agricultural enterprises. This has been done in almost 5000 enterprises and organizations of the national economy, including 3184 agricultural enterprises, 676 central bureaus of budget institutions, and 820 consumer cooperative enterprises.

Work has also been done in improving planning and management of the TsSU computer network, introducing new forms of work organization at computer centers and stations, improving working conditions, and implementing safety and hygiene measures. Copying and reproducing facilities were further developed. Statistical compilations were published on time, and processing completed of the results of the 1979 national census.

The basis for the comprehensive plan for development of the TsSU computer network and mechanization and automation of statistical and accounting work for 1983 was the TsSU measures stemming from the decisions of the 26th CPSU Congress and the May and November (1982) Plenums of the CPSU Central Committee to expand the mechanization and automation of accounting-computing work, and the production and economic indices attained in the first two years of the Five-year Plan by the TsSU computer network.

What are the main factors affecting the 1983 plan's basic indices?

First, changes in the work structure due to the substantial increase in the volume of work performed by computers. Second, the reduction in the planned number of personnel in the computer system, causing a growth in the volume of work solely through the growth in labor productivity resulting from the use of modern computers. Third, the substantial growth in computer work volumes, affecting the change in the structural composition of personnel (the number of operators declines, while that of engineering and technical workers grows). Fourth, the stability of capital investments, which remained at the 1982 level.

Considering these factors and the 1982 indices attained, the 1983 plan called for an increase in workloads by 0.5%; in labor productivity, by 2%; in average wage per worker, by 1.5%.

The features of the 1983 plan and the conditions for its realization should be singled out. For the first time, concrete assignments are established for conserving material, raw material and fuel resources by a specified sum, as welll as plans for supplying the main types of paper information media: punchcards, paper punch tape for printers. Progressive norms for using equipment of punch, electomechanical and keyboard computers, whose use substantially reduces such machines' down times, will also be introduced.

The planning tasks for 1983 are better balanced in terms of the financial resources directed towards the basic work: ASGS creation; VTsKP creation and development; expansion of computer services for economic enterprises; and strengthening the material and technical base for the TsSU computer network.

Special attention will be devoted to fulfilling the assignments to strengthen the material and technical base of the rayon level, due to the expansion and improvement in mechanized processing of statistical and other information by firms of the agroindustrial complex. As before, expanding and improving comprehensive mechanization of bookkeeping in agricultural enterprises is given great weight.

The importance has been noted of performing methodological work to improve the computer network's economic mechanism. For example, the first practical results will be obtained from operation of the Konotop main computer and data processing center for a sector of industry (GIVTs), using a new planning and incentive system. Six more computer organizations will be transferred to this system this year, including the computer center of Statupravleniya of the Kuybyshev oblast. Certain normative documents will be reviewed, notably the standards for allotment to the computer center economic incentive fund from planned and above-plan profits, as well as the bonus sytem for computer organization personnel.

The plan for development of the automated system of state statistics for 1983 was compiled above all considering the Summary Plan for ASGS Creation and Development for the 11th Five-Year Plan. There will be 148 EOI complexes operating in 1983, including 38 system ones and 110 union ones.

The 1983 plan for creation, development and operation of EOI complexes, coordinated with the administrations (departments) of TsSU, includes the following sections (subsections): Modification of 8 EOI complexes according to the decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979; creation of 26 new system EOI complexes and transition to the unified computer system; improvement of the designs of 22 system EOI complexes; operation of 38 system EOI complexes; creation of 8 new union EOI complexes, including transfer of existing ones to a ujified computer system; improvement in design work for 12 union EOI complexes; and operation of 110 union EOI complexes.

The 1983 plan for creation, development and operation of EOI complexes includes work for 16 new EOI complexes, nine of which are in the plan for the first time. In addition, the 1983 plan includes seven EOI complexes excluded from preceding plans, including two requiring complete reprogramming due to the change in statistical report forms (form No. 9 annual; form No. 1-tp annual).

Six complexes will not operate in 1983: "Calculation of Staff Size by Profession, Wage Category, and Work Payment Forms and Systems in Industry, Construction and Other Sectors of Material Production", "One-Time Selective Investigation of the Incomes of Families of Workers, Employees and Kolkhoz Workers for September", "One-Time Calculation of the Change in Cost of Actually Delivered Output in 1980 in Connection with Introduction of New Wholesale Prices", "Processing Materials from an Investigation of Budgets in Groupings by the Size of Average Per Capita Aggregate Income and Several Other Social and Economic Criteria", form No. 1-mekh., "Size and the Wave Fund of Workers and Employees in the National Economy", "September Program" (in connection with the inclusion of form No. 1-t annual).

It is planned to develop the "Guidelines for ASGS Development" and "Techique for Determining Economic Effectiveness of the Third ASGS Stage", continue work on developing ASGS functional subsystems and on the interaction of ASGS's with the ASPR [automated control system for planning calculations] and ASU [automated control systems] of ministries and departments, etc. ASGS hardware and software will be further developed.

As of 1982, the GVTs [main computer center] of TsSU is defined as the leading organization in the creation of EOI complexes, responsible for methodical management of the creation and operation of complexes throughout the TsSU computer system. A first practical result in this direction is the planned 1983 introduction of a unified operational system at TsSU computer centers, a major step in creating a unified software medium for statistical information processing.

To further improve statistical data processing and raise the level of economic analysis, work will continue on creating automated data banks (ABD) at several RVTs [republic computer centers] of union republic TsSU's and at VTsKP's. In 1983, there should be defined, together with TsSU administrations and departments, the standard composition of the indices of the ABD data base for the ASGS functional subsystems, and program ABD documentation developed in the unified computer operating system; TsSU algorithms and programs will be transferred to the fund.

An important part of this year's plan is work to transfer to a modern technical base (computers and communication channels) the rush statistical reports on fulfillment of plans for capital construction (forms No. 2-ks, 1-ks, urgent) and of industry in natural terms (form No. 1-p, urgent and others). For this, work will continue on creating the second STOSI stage. It is planned that in 1983 means will be developed for remote collection of urgent statistical reports in STOSI via a subscriber telegraph network.

The process of creating and developing ASGS functional subsystems involves problems of their practical interaction with the corresponding subsystems of the ASPR's, ASFR's [automated system for management of financial calculations], and other sectoral automated control systems. Such interaction will be expanded in 1983 by increasing the number of EOI complexes, enabling exchange of required data.

The plan for VTsKP creation and development of the TsSU for 1983 is an integral part of the computer network's working plan for the 11th Five-Year Plan to implement the tasks of the comprehensive scientific and technical program. For example, the following are planned: complete a series of scientific research studies on this question; perform experimental operation of ABD's and STOSI's at the VTsKP's of the TsSU system; develop and approve the organizational-personnel structure and instructions on departments at all newly organized VTsKP's; finish design of "Data Transmission Channels" sections for VTsKP's in Minsk, Tallin, Voronezh, Saratov, Brest and Frunze, thereby completing these projects' development for all the VTsKP's created; continue developing the VTsKP legal, organizational and software supply; expand work on building data transmission channels for the VTsKP's in Vinnits, L'vov and Alma-Ata. The VTsKP's created will be equipped with the necessary hardware this year.

Planning and technological work on creating system-wide projects, and especially working designs on automating data processing of VTsKP subscribers, is very important. This will be the final period before experimental operation for the VTsKP's in Voronezh and Vilnius.

Republic collective-use computer centers are the foundation for practical introduction of STOSI's in the TsSU system; the quality of their technical base enables introduction of practically automated data banks for the main ASGS functional subsystems. Industrial introduction of new hardware and software of this class will raise the level of integration and the quality of statistical information processing. Much importance is attached to strengthening the economic mechanism of VTsKP production activity.

At the present time, 13% of the accounting report information received from 91,000 economic enterprises and organizations is processed by computer. About 40% of all enterprises and organizations served are in the agroindustrial complex.

Complete accounting mechanization will be introduced in 1983 at 441 agricultural enterprises, 325 enterprises of consumer cooperation and 186 central bureaus of budget institutions. The most important tasks of TsU computer organizations in the area of information-computer service of economic enterprises have been and remain raising the level of service completeness, improving work quality and

observing the established deadlines for generating accounting report data. Special emphasis will be laid on information service to oblast and rayon agro-industrial associations. Fulfilling the program for developing and introducing comprehensive mechanization of bookkeeping will halp considerably in developing the thoroughness of processing accounting report information of economic enterprises and organizations. Several such projects for the unified computer system and SM-1600 will go into industrial use for computer centers of the TsSU system in 1983.

The material and technical base for the TsSU comptuer network will be developed further. Computer center buildings will go into use in Blagoveshchensk, Elist, Fergan, Semipalatinsk, Chimkent and Alma-Ata, along with over 30 buildings at the rayon level.

Computer centers and stations will be constantly equipped with new hardware. The computer centers at the republic, oblast and rayon levels, including the VTsKP's, will receive the YeS-1060, YeS-1055, YeS-1035, PVK M 5100, EFBA "Robotron-1720", EUPD "Robotron-1373", EFBM "Iskra-2106" and R-810 magnetic disk data preparation devices.

The average daily computer load will go up compared with 1982 (by 15% for the unified computer system, and 11% for the PVK M 5000, 5010 and 5100).

The union, republic and oblast levels of the TsSU computer network have been reequipped with unified computer system machines and additional peripheral equipment, mainly magnetic disk memories, I/O devices and punchless data preparation equipment, which will undoubtedly raise their productivity.

The rayon level will also be reequipped. First, tabulators and other computer punch machines will be replaced by the M 5100 PVK, and later by the SM-1600. Second, the stock of electromechanical computers (accounting, invoicing) will be updated, primarily with the "Iskra-2106" and "Robotron-1720" microcomputers (and later the 5130).

It should be pointed out that the TsSU computer network is still using a substantial number of punched cards. Computer centers and stations will gradually be equipped with magnetic media in connection with the increase in the delivery plan for new computers.

Introduction of more modern punchless technology and the delivery of new computers will result in gradual reduction in punched card use. It declined by about 100 million pieces compared with 1981, and will drop by the same amount in 1983. Deliveries of the remaining types of paper media and of paper remain at the 1982 level.

Measures will be implemented for social development of the personnel of computer centers and stations of the TsSU system. Construction of recreation facilities (rest centers), increasing the number of cafeterias and snack bars at TsSU computer centers and stations, performance of capital repairs, etc., are provided.

In implementing the decisions of the November (1982) Plenum of the CPSU Central Committee with respect to the tasks and conditions of the TsSU computer network, its staffs and organizations have initiated organizational and mass political work to fulfill and overfull the 1983 planning assignments. Special attention is devoted to strengthening state, labor and executive discipline, extending socialist competition, more efficiently using labor, material and financial resources, obtaining optimum final results, and ensuring strict control of current and future decision implementation.

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FIRST SOVIET-WEST GERMAN SEMINAR ON OPTICAL PROCESSING OF IMAGES

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[Article by V.P. Koronkevich and P.Ye. Tverdokhleb]

[Text] The First Soviet-West German Seminar, at which the results of research and developments in the field of the optical processing of images were discussed, was held at Akademgorodok in Novosibirsk, under the sponsorship of the Institute of Automation and Electrometry, from 2 to 7 August 1982.

The German scientists represented university optics laboratories from the cities of Essen, Erlangen, München, Göttingen and Frankfurt, as well as the Institute of Applied Physics in Darmstadt and the Phillips Company's research laboratory.

The Soviet delegation consisted of associates from institutes under the USSR Academy of Sciences (FI [Physics Institute] imeni P.N. Lebedev, FTI [Physicotechnical Institute] imeni A.F. Ioffe, IAiE [Institute of Automation and Electrometry]), the State Optical Institute imeni S.I. Vavilov and the All-Union "Lesproyekt" Association.

Reports From the West German Delegation

G. (Khesler's) report, "Television-Optic and Digital Processing of Images," was devoted to hybrid opticoelectronic methods of processing images. The systems that realize these methods include noncoherent optical analog systems, television systems and digital devices. Optical systems are used for low-frequency filtration, as well as for inverse iterative filtration. Television systems expand processing capabilities by introducing a subtraction (differentiation) operation and realizing negative feedback. Digital devices are used to store data (a memory on one or two frames), as well as for correcting analog subsystems (tabular methods of realizing nonlinear transformations).

In the report entitled "Statistical Processing of Images in Astronomy and Biology," G. (Veygel't) discussed prospects and possibilities of spekl [translation unknown] methods. He noted that the resolution of a tradition astrophotographic system (a telescope) is limited by fluctuations in the refractive index of the Earth's atmosphere. A radical improvement in resolution can be achieved with the help of stellar spekl-interferometry. In this case a large number of instantaneous images of astronomical objects are registered, each of which consists of random interference structures (spekls). Then the power spectra of the images are averaged, after which an inverse Fourier transform is realized and the autocorrelation function of the

original object is computed. This method was used to process data obtained with a 3.6-m telescope and made it possible to improve resolution by a factor of 30-50.

In R. (Roler's) report, "Image-Processing Methods Based on the Properties of Visual Systems," he discussed the possibility of using, in technical systems, image-processing methods that are inherent in the human visual system.

T. (Tshudi) and F. (Laeri), in their report "Coherent Optical Feedback," discussed questions concerning the processing of information in optical systems with active feedback. A comparison of open and closed optical systems shows that the latter have substantial advantages: in them it is easy to realize nonlinear transformations and solve inverse problems effectively.

Kh.V. (Shisler) and P. (Stefen) presented a report entitled "Unidimensional Processing of Two- and Three-Dimensional Signals With the Help of Recursive Systems." They recommend that two- and three-dimensional signals be processed so that when the recursive procedure is used, the dimensionality of a processed image is not increased in comparison with the one that is being processed. This is achieved by using two-dimensional masks that "zero out" as they approach the signal's boundary. In this case the system obtained is an invariant one.

In O. (Bringdal's) report, "Optical Transformations," he discussed the realization and possibilities of new optical elements that can transform wave fronts into practically any form. The elements are produced in the form of holograms synthesized on a computer.

I. (Hofer-Al'fays's) report, "Analog-Optical Method of Computing Multidimensional Convolution," discussed the results of experiments for the realization of three- and four-dimensional convolution operations.

In A.F. (Ferkher's) report, "Use of Laser Spekl Methods in Ophthalmology," he reported on two new methods for studying the movements of the human eye and the blood flow in the vessels in the bottom of the eye. In the first of them, an interference method is used to measure the contraction and expansion of the eyeball, whereas in the second, spekl methods are used to visualize the blood flow in the blood vessels in the bottom of the eye.

The subject of V. (Lauteborn's) report, "Digital Processing of Three-Dimensional Objects Recovered From Holograms," was the results of an investigation of the movements of turbulent bubbles with the help of high-speed holography and digital processing of the three-dimensional images. The working program also proposes the investigation of the mechanisms of acoustic cavitation and the solution of the problem of processing three-dimensional tracks of elementary particles.

In V. (Martinsen's) report, "Fluctuation Phenomena in Classical and Nonclassical Light Fields," he explained the ideas presently held about the statistics of photons in different radiation fields.

G. (Bays's) report, "Images of a Synthesized Aperture in X-Rays," discussed the development by the Phillips Company of an X-ray tomographic system that is used for medical diagnostic purposes. He showed a series of tomograms obtained by impulse tomosynthesis. The constriction of blood vessels in connection with stenocardia was easy to see in the tomograms.

Reports From the Soviet Delegation

In Yu.V. Chuguy's report, "Using Fourier Optics Methods for Industrial Monitoring," he discussed questions concerning the use of Fourier optics methods for the purpose of monitoring the geometry of machine-building goods. He also discussed the possibilities of three high-speed monitoring methods: spectral, correlational and shading (on the basis of scattered waves).

For the purpose of realizing remote methods for determining forest resources and the status of forests, the All-Union "Lesproyekt" Association has created and is operating a specialized complex of equipment that has been put together on the basis of both Soviet and foreign technology. R.I. El'man discussed the operation and capabilities of the complex in his report, "Ways and Means for Automating the Processing of Aerospace Photographs of Forests."

In "Crystals and Glasses in Information-Processing Systems: Physics of Memory Phenomena and Examples of Use," V.K. Malinovskiy and Yu.Ye. Nesterikhin discussed, from common positions, the phenomena of an optical memory in ferroelectrics, glasses, KhST [expansion unknown] films, photochromic glasses and germanium and silicon sillenity [translation unknown] irradiated by light.

In the report given by Ye.S. Nezhevenko and M.A. Gofman, "Active Feedback in Systems for the Opticoelectronic Processing of Images," they presented the principles of the construction of analog optical computing systems based on controllable electro-optical transparencies.

A complex for the digital processing of images that is based on new hardware and software has been created at the IAiE of the Siberian Department, USSR Academy of Sciences. The operation of the complex was explained in "Problem-Oriented Complex for the Digital Processing of Images," which was written by N.S. Yakovenko and others. The speaker presented the results of the solution of the following applied problems: stellar parallax, the tracking of the Sun's spectral lines, the combination of six-band photographs taken with the MKF-6 camera.

A.A. Vasil'yev's report was a review of the results of research done by the USSR Academy of Science's Physic Institute imeni P.N. Lebedev in the field of controlled liquid-crystal transparencies in the last 2 years.

In his report, "Photorefractive Crystals in Optical Information Processing and Holographic Interferometry," M.P. Petrov discussed photorefractive crystals of the $Bi_{12}SiO_{20}$ type, which are used as a component of spatiotemporal modulators (PROM, PRIZ) and as a memory medium.

M.M. Miroshnikov's report, "Evaluating and Processing Medical Information in the Form of Images," was devoted to a discussion of general questions of iconics, which is a scientific field involving the study of the general properties of image and the determination of the purpose and reason for transforming them. Special attention was given to the laws of visual perception.

In V.P. Koronkevich's report, "Cineform Optical Elements," he presented the experimental results of the synthesis of phase diffraction elements (cineforms), which are used in interferometry to transform reference wave fronts, as well as the creation

of compensators for the correction of image aberrations, optical elements for the control of laser beams, and new elements for the transformation and encoding of images.

In "Holographic Information Systems," prepared by I.S. Gibin and P.Ye. Tverkokhleb, they discussed contemporary methods for building holographic information systems and their basic structural elements, which are specialized for the entry, storage, processing and display of documentary data. The principle of the organization of a multifunctional information system was illustrated by using the experimental holographic memory system developed at IAiE as an example.

The texts of the German delegation's reports will be published in detail in issues of AVTOMETRIYA in the near future.

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